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The Hippocratic Oath For Engineers

DOCTORS and surgeons will come out of this war not only with clear consciences but with the heartfelt thanks of humanity regardless of race or party. They have exerted themselves to the utmost to save human life.

Engineers, on the other hand, will not be able to have this said of them. They have done a wonderful job in helping to destroy human life. Think of what war would be today without airplanes, rocket guns, tanks, submarines and the countless other instruments produced by engineering genius.

I realize that I am inviting some very caustic comments from my engineering friends in making this statement. They will write me and ask if I would prefer to have them hold back and permit the Axis powers to go forward with their destruction engineering and thus become rulers of the world. And I will have to admit that I would not.

I want to see this war won and when it is, as it will be, a large part of the credit for winning it will go to the engineers and designers of our fraternity. But I want to see it stay won and I think that engineers and designers should have a voice in this too and not have it left to the politicians after we and the armed forces of the Allies have done the necessary killing and maiming.

Personally, all of the engineers whom I have ever met, of whatever nationality, are peaceable people who like to solve problems rather than to invent problems that will hurt others who may have to solve them. I never knew an engineer who wanted to kill anyone, even though that person might have been a professor who flunked him in physics or mathematics. Most engineers, I am sure, when they invent some new machine have it in mind to make things easier and not harder for people.

This war is the last chance for humanity and for the engineers who are a part of it. For unless, after we win the war, we make it impossible for anyone ever again to practice destruction engineering, none of us will have to die to go to hell.

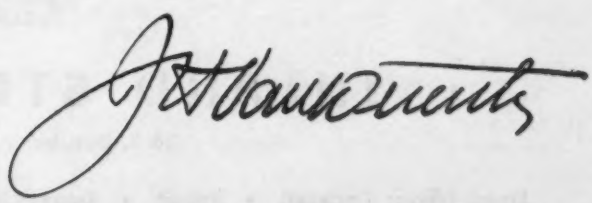
The robot flying bomb makes that perfectly clear. It has come too late to save the Axis but give any capable group of engineers ten or fifteen years more to develop and perfect it and there will not be a city anywhere on earth whose inhabitants will not have cause to live in daily and nightly fear of annihilation by explosions, fires or poison gas.

If, as demonstrated by the Germans, you can successfully fly a one ton bomb for sixty miles, it inevitably follows that improvement and development will enable you to fly a fifty ton bomb not merely a hundred miles but perhaps a thousand. And then where are you?

These implements of destruction could not be made by politicians. They are made possible by engineers and technicians. Even the airplane was first conceived and developed as an instrument for war. That's a heavy responsibility on our shoulders.

Doctors and surgeons take the oath of Hippocrates before they start to practice and live up to it afterwards. They swear that they will use their knowledge and skill to save human life and not destroy it.

If engineers throughout the world would agree to take the same oath, there would be no more war.



(Courtesy Food Machinery Corp.)

"Water Buffalos," at home on land and sea, aided in taking Makin Island. They have helped solve the problem of landing troops on enemy-held beaches.

Buffalos That Roam Land and Sea

At the extreme western end of Makin Island, the surf was too high for successful landing operations—so the Japs thought. They heavily guarded a small opening in the reef, where there was little surf. But the Allied forces, using amphibian tanks plunged through the high breakers, passed over the reef, crossed the lagoon and soon wiped out a superior Jap force.

These amphibian tanks, known as "Water Buffalos," or "Water Bronks," are built by the Food Machinery Corporation, and into them go many tons of steel supplied by Inland. They are hard hitting tanks, equally at home on land or in the water, that are making island hopping history in the Southwest Pacific.

Thousands upon thousands of tons of steel from Inland now are being used to build many types of fighting equipment —ships, tanks, guns, bombs, trucks, etc., that are used wherever men fight for freedom. Tomorrow, when Victory is ours, Inland will again supply steel for America's peacetime needs. We invite your inquiries.

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The IRON AGE

NEWS FRONT

July 11, 1944

► Although WPB announced a fortnight ago that experimental model production and tooling for civilian automobile requirements would be authorized, no orders have yet come through. General expectation is that these orders will be first released when the automobile company presidents hold their second reconversion conference with WPB, July 14.

WPB will not permit production to start until Germany falls, or until the fall is definitely in sight. Detroit is generally of the opinion that that position will be reached by the end of the year.

► American bombers are delivering more than 2,500,000 propaganda newspapers and leaflets daily to the people of Germany and occupied Europe.

► First traces of decreasing war production are in evidence in Cleveland. War plants are increasingly prone to observe all vacations and to lay off men when any contract hitch occurs.

► Highway construction must be doubled after the war, according to the American Road Builders' Association.

► Die-casting machines of the prefill injection type are being increasingly favored. The equipment virtually eliminates porosity in non-ferrous castings of a size heretofore considered beyond the range of commercial die-castings.

► Boron may be substituted for nickel, molybdenum or chromium in the forging steels NE9440 and SAE 4640. The substitution gives better hardenability, and equal tensile impact and machinability properties.

► Band instruments are now being made in regular commercial quantities by electroforming or building up by electrodeposition. The technique differs radically from ordinary plating practice and calls for the last word in control equipment.

► A new bright alloy plate consisting of ternary deposits of copper, tin and zinc, has been made available commercially. The alloy is bright as deposited, hard, has good tarnish resistance, is non-magnetic and has high protective value over copper or copper alloys. It is recommended to replace nickel plate.

► Builders of the West, Inc., is an organization pledged to the development of the West. If it can assure a base price on finished iron and steel at Los Angeles, San Francisco, Portland and Seattle within $3 or $4 or at the most $5 a ton of Pittsburgh, Chicago, Birmingham and Baltimore, West Coast manufacturers will consider its mission accomplished.

► Captured German oil and gasoline, being based on synthetic processes, are strikingly different from U. S. types, but are still of very high quality. Germans habitually blend tetraethyl lead, benzol and alcohol to gasoline base stocks in the field. The Allies ship their fuel already blended.

► About 7,000,000 lb. of aluminum is being released in the third-quarter for food cans and containers, as a substitute for tinplate. The latter has a tight supply outlook.

► San Francisco Chamber of Commerce states that the average weekly earnings of workers in that area is $59.53, for 45.1 hr. of work.

Manpower shortage on the Pacific Coast is increasingly severe, resulting in shipyards and other war plants falling behind production schedules.

U. S. Maritime Commission states that Pacific Coast shipyards will be loaded with even heavier orders that will maintain peak production through 1945.

► The trend of prime contractors drawing former sub-contract work into their own shops thus cutting out some of the smaller companies is concerning the WPB and the armed forces. This trend is inclined to cause some unemployment in sub-shops where labor is generally easier and tightening the labor demand in prime contract areas where labor is mostly acute.

► Machine tool builders have keenly felt the loss to the draft of men under 26. This is the age group where greatest initiative and versatility are found, industry spokesmen explain. In fact, much of the credit for the machine tool industry's recent record of building 13 years' normal production of tools in about three years goes to these younger men.

Boron in NE 9440 and

THIS work was planned as a continuation of the comparisons of various Bortam or Carbortam treated steels with similar steels containing molybdenum or extra manganese instead of boron, that were previously published by the writer*. The object of the present work was to extend a similar comparison of boron with other alloys, to nickel and chromium in some of the modern and widely used low alloy forging steel.

* THE IRON AGE, *Sept. 9, 1943, p. 48; and* Metals and Alloys, *May, 1943, p. 978.*

Thus in the NE 9440 steel, a standard composition was compared with Carbortam treated steels which lacked either part of the manganese, or most of the chromium, or the nickel and molybdenum; and in the SAE 4640 steel, standard compositions with low and high nickel respectively were compared with Carbortam treated steels without either most of the nickel or most of the molybdenum. Tensile and impact tests were made on forged bars of these steels quenched in oil and tempered at various temperatures from 600 deg. to 1200 deg. F.; and Jominy hardenability tests and a few machinability tests were also made.

In the NE 9440 steel, Carbortam treatment giving only 0.0022 per cent residual boron did not maintain the hardenability when the manganese was reduced by 0.57 per cent and the molybdenum by 0.02 per cent. Carbortam treatment giving 0.003 to 0.004 per cent residual boron did maintain the same or higher hardenability, however, when chromium was omitted, or when nickel and molybdenum were both omitted, except for the residual contents obtained from scrap. In the SAE 4640 steel, the same Carbortam treatment gave equal or better hardenability than 1.20 per cent nickel or 0.25 per cent molybdenum. The replacement value for chromium seems from this work to be about 0.6 per cent, instead of 0.35 per cent as was previously suggested.

The tensile and impact properties of oil quenched and tempered specimens are approximately the same, whether Carbortam or the other alloys are used; but the tempering temperature may require adjustment, especially when molybdenum is omitted, since molybdenum steels are not tempered as readily as other alloy steels. Machinability tests also show no difference. There is considerable economy in using Carbortam instead of nickel, molybdenum, or chromium in these heat treated forging steels, equivalent properties being obtainable at a saving of about $5.25 per ton of steel when the substitution is made for nickel, $3 per ton in the case of molybdenum, and about $1.50 for chromium. The same benefits in tensile, impact, and machining properties that are found when the boron alloy treatment is substituted for higher managanese are not found, however, when the substitution is made for nickel or chromium.

Materials Used

The steels used in this investigation were melted in a 17 lb. basic lined induction furnace using low carbon wire rods as the chief melting stock. This stock was found to contain about 0.12 per cent nickel, 0.09 chromium, and 0.01 per cent molybdenum. All the heats contained 0.39 to 0.42 per cent carbon, 0.20 to 0.33 per cent silicon, 0.025 to 0.037 per cent sulphur, and about 0.018 per cent phosphorus. Boron was used only in the form of Carbortam, all the treated steels receiving an addition of 10 lb. per ton, or about 0.08 per cent titanium and 0.005 per cent boron. In these steels 1.25 lb. aluminum per ton was added before the Carbortam, and all the other steels were deoxidized with 1.5 lb. aluminum per ton. Their analyses are given in Table I.

The 2.5 to 3-in. square ingots were heated up to 2000 deg. F. in about 2.5 hr. and held at that temperature for 1 hr. before forging. They were forged rather slowly, with several periods of reheating, to ⅞-in. round bars, finishing at a bright red heat. These

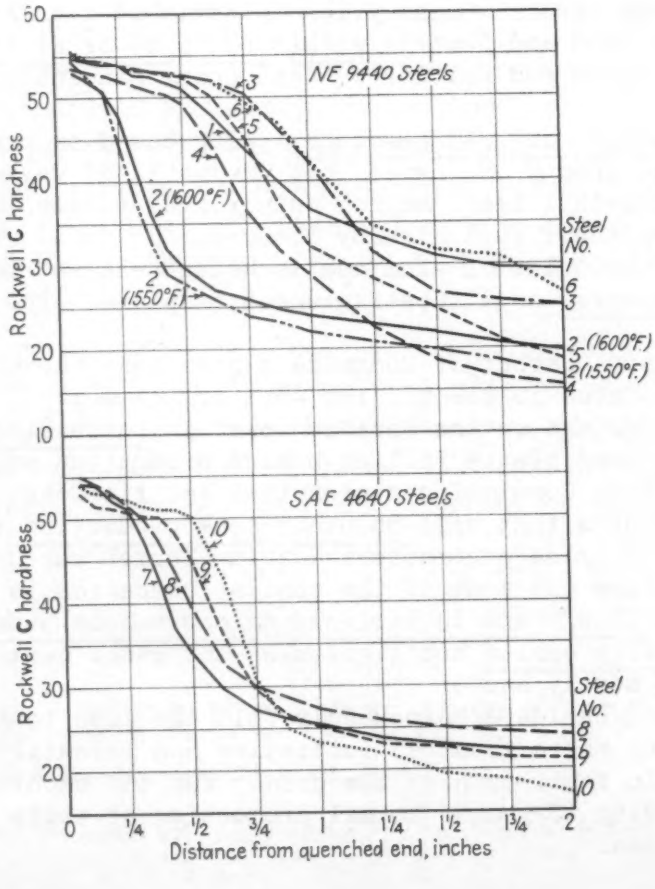


FIG. 1 — Hardness distribution along sides of end-quenched specimens.

SAE 4640 Steel

By G. F. COMSTOCK
Metallurgist, Titanium Alloy Mfg. Co., Niagara Falls

. . . Considerable economy is possible in the substitution of boron for nickel, molybdenum or chromium in the heat treated forging steels, NE 9440 and SAE 4640. The substitution gives equal or better hardenability; and tensile, impact or machinability properties show no difference. Tempering temperature may require some adjustment, especially when molybdenum is omitted.

bars were cut with a hacksaw into suitable lengths for the test specimens, and all of them were normalized 2 hr. at 1650 deg. F. before machining.

Hardenability Tests

These tests were made by the Jominy end-quench method, using specimens machined to ¾ in. diameter and heated for 1 hr. at 1550 deg. F. before quenching. An extra specimen of Steel No. 2 was quenched from 1600 deg. F. The Rockwell C hardness was determined on duplicate flat strips ground carefully along the sides of the quenched specimens in the usual way, and average values are shown plotted against the distance from the quenched end in Fig. 1.

The hardenability of Steel No. 2 was found to be very low, compared with the other steels, and no further work was done on this heat. The boron recovery in it was lower than in the others, and evidently the 0.002 per cent of boron retained by the steel was not sufficient to compensate for the lower hardenability resulting from the deficiency of 0.57 per cent in manganese and 0.02 per cent in molybdenum as compared with the non-boron steel No. 1. Since sufficient data comparing the relative effects of manganese and boron seemed to be available from the THE IRON AGE article,* it was not thought necessary to make this heat over again for the present work.

The other hardenability curves for the NE 9440 steels in Fig. 1 show a more gradual slope for the No. 1 steel characteristic of molybdenum and a steeper drop for the others, characteristic of boron. Steel No. 3, with boron, nickel and molybdenum, shows the highest hardenability, though steel No. 6, with boron and higher chromium than No. 1, though without nickel and molybdenum, is a very slose second. Steels Nos. 4 and 5, with boron and lower chromium, gave curves placed as might be expected from their chromium and manganese contents. The Carbortam treatment in the NE 9440 steel is thus seen to be about equivalent, in its effect on hardenability, to about 0.43 per cent nickel plus 0.13 per cent molybdenum, but to exceed considerably the effect of 0.38 per cent chromium (comparing steel No. 3 with No. 1). Also, comparing the Carbortam treated steels Nos. 3 and 6, it appears that the hardenability effect of 0.58 per cent chromium is about the same as that of 0.36 per cent nickel plus 0.10 per cent molybdenum. Therefore, the Carbortam effect seems to be equivalent to much more than 0.35 per cent chromium as was estimated by Crafts and quoted in the writer's IRON AGE article.* The present comparisons with nickel and molybdenum, however, seem to be in fair agreement with previous estimations.

In the SAE 4640 steel, a comparison of the hardenability curves for Nos. 8 and 9 shows that the Carbortam treatment gave very slightly greater hardenability than 1.19 per cent extra nickel, which agrees well with the previous estimation for nickel as quoted in the IRON AGE article. Comparison of the curves for steels Nos. 7 and 10 indicates a much greater hardenability from the Carbortam treatment than with 0.23 per cent extra molybdenum, which is not in very good agreement with the writer's

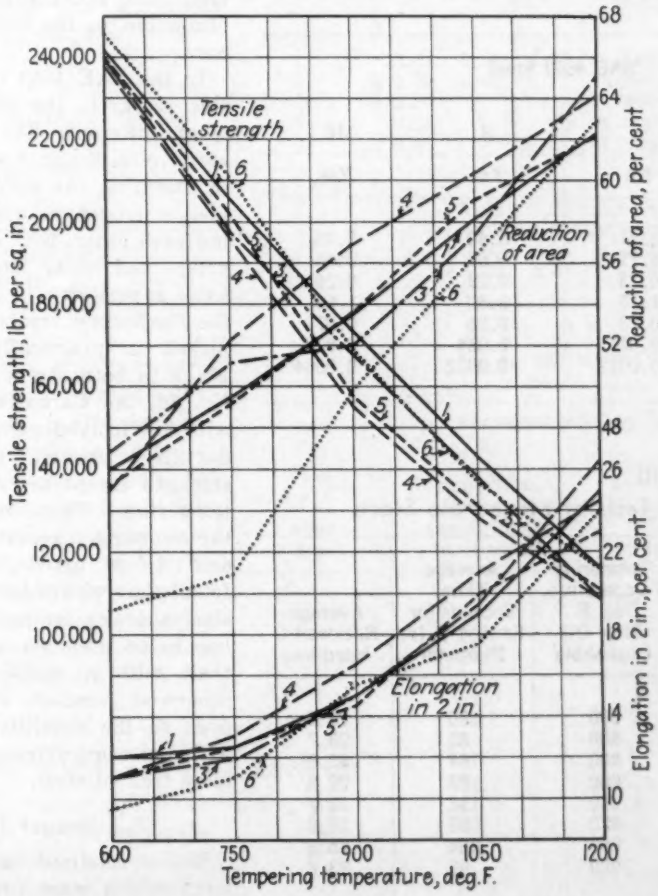


FIG. 2 — Variation of tensile properties with tempering temperature, in NE 9440 series, quenched in oil from 1550 deg. F.

previous work. This is probably due to the fact that this boron treated steel No. 10 was not entirely free from molybdenum, and may, therefore, be considered as additional support of the claim that the boron alloy treatment is at least as effective as about 0.25 per cent molybdenum. It should be noted however that in both the NE 9440 and the SAE 4640 series, the molybdenum steels (except for No. 2) gave hardenability curves that were definitely above those for most of the other steels at their lower portions, or with the slower cooling rates. This distinctive effect of molybdenum was noted previously in the *Metals and Alloys* article.* Steel No. 6 here, with high chromium, however, seems to indicate that chromium above about 0.55 per cent may have the same effect as smaller molybdenum contents on the hardness of the slowly cooled parts of the Jominy test bar.

Tensile Tests

The normalized specimens for tensile testing were machined to about 0.52 in. diameter for a 2 in. gage length, heated to 1550 deg. F. for 1 hr. and quenched in oil. Separate specimens were tempered 2 hr. at 600 deg., 750 deg., 900 deg., 1050 deg., and 1200 deg. F. respectively, and then finished to about 0.500 in. diameter by grinding. The bars were pulled slowly, in the usual way, the yield points being recorded at the drop-of-the-beam, which was well marked in the bars tempered at the lower temperatures, and was checked with a strain gage on the other specimens. The results are reported on Figs. 2 and 4, except for the yield points which are on Figs. 3 and 5. These curves show the variation of the tensile properties with tempering temperature for each steel, the NE 9440 steels appearing on Figs. 2 and 3, and the SAE 4640 steels on Figs. 4 and 5.

Among the NE 9440 steels, No. 1, the regular steel without Carbortam treatment, shows in general about the highest tensile strength and yield point, with fair ductility. The high chromium steel No. 6, where Carbortam replaced nickel and molybdenum, approaches No. 1 most closely in strength, but is deficient in ductility, especially in reduction of area at the lower tempering temperatures. No. 4, the similar steel with low chromium, shows the best ductility, but the lowest strength. The other Carbortam treated steels, No. 3 without chromium and No. 5 without nickel or molybdenum, are hardly any better than No. 1 in ductility and in general slightly below No. 1 in strength. There does not seem to be much difference, in tensile properties after tempering, between fully hardened NE 9440 steel and similar steel with Carbortam treatment substituted for either the chromium, or the nickel and molybdenum.

In the SAE 4640 steels included in this research, the situation is somewhat different. The two untreated steels Nos. 7 and 8 were about equal in strength, the differences in nickel and molybdenum apparently balancing each other, but No. 8 with higher nickel and lower molybdenum shows some superiority in ductility. No. 9, the Carbortam treated steel with low nickel, is practically equivalent to No. 8 in both strength and ductility. No. 10, the Carbortam treated steel with low molybdenum, shows superior ductility, though generally lower strength except after the 600 deg. F. tempering. This supports very well the comparison reported in the *Metals and Alloys* article,* where it was found that with a boron alloy treated steel a lower tempering temperature has to be used for a given strength than with a molybdenum steel of otherwise similar composition, but even so the ductility will be better, with the same strength, in the boron alloy treated steel.

Impact Tests

The normalized impact test specimens which were prepared for tem-

TABLE I
Chemical Analyses of the Steels Used

	NE 9440 Steel					
Heat No.	1	2	3	4	5	6
Carbortam	No	Yes	Yes	Yes	Yes	Yes
C	0.41	0.41	0.42	0.39	0.41	0.41
Mn	1.04	0.47	1.07	0.87	0.95	0.96
Si	0.25	0.24	0.26	0.33	0.31	0.28
Cr	0.47	0.46	0.09	0.24	0.53	0.67
Ni	0.55	0.55	0.48	.....	0.12	.....
Mo	0.14	0.12	0.11	.....	.....	0.01
Ti	0.016	0.038	0.044	0.031	0.044	0.037
B	0.0004	0.0022	0.0040	0.0030	0.0032	0.0040

	SAE 4640 Steel			
Heat No.	7	8	9	10
Carbortam	No	No	Yes	Yes
C	0.40	0.41	0.40	0.40
Mn	0.68	0.71	0.63	0.64
Si	0.20	0.23	0.23	0.26
Ni	1.56	1.79	0.60	1.54
Mo	0.30	0.23	0.25	0.07
Ti	0.018	0.016	0.054	0.036
B	0.0004	0.0012	0.0032	0.0034

TABLE III
Results of Sawing and Hardness Tests of Manganese Steels

Steel No. Referring to THE IRON AGE, Sept. 9, 1943, P. 48	Analysis, Per Cent			Tempering Temperature, Deg. F., After Oil Quenching	Average Time, Seconds for Sawing ¾ In. Diameter	Average Rockwell C Hardness
	C	Mn	B			
8M	0.28	2.00	.....	900	90	26.8
9M	0.28	1.23	0.0038	900	85	28.7
10M	0.40	1.70	.....	900	164	30.5
12M	0.40	1.12	0.0042	900	87	29.8
10M	0.40	1.70	.....	930	158	28.7
12M	0.40	1.12	0.0042	870	86	28.9
2M	0.37	1.83	.....	900	204	25.6
3M	0.36	1.26	0.0015	900	99	23.8

pering at 600 deg. or 750 deg. F. were finished 0.394 in. square and notched with three standard Izod V-notches before hardening in oil from 1550 deg. F. The notches were protected by a refractory coating from scaling when the specimens were heated for quenching. The specimens intended for tempering at 900 deg. F. or above were rough machined about 0.42 in. square before quenching in oil from 1550 deg. F., and finished to 0.394 in. square and notched after tempering. The Rockwell C hardness was determined on the sides of the finished specimens between the notches. The impact tests were made in the usual way with a 200 ft.-lb. blow at room temperature, and the results are plotted on Figs. 3 and 5, each point being the average value from three tests. The hardness values are also plotted on the same charts.

In Fig. 3, the Carbortam treated steels are seen to be generally superior in impact resistance to the regular NE 9440 steel No. 1 except after tempering at the highest temperature, 1200 deg. F. The No. 1 steel was harder, however, after each tempering treatment. The low chromium steel No. 4, which had the lowest strength, showed the best impact values after most of the tempering treatments. The Carbortam treated steel No. 5, without nickel or molybdenum, was tougher than No. 1 after all tempering treatments except 1200 F., and No. 3, without chromium, was better after all treatments except 1050 deg. F. and especially superior after tempering at the lower temperatures. The hardness values of the impact specimens are in roughly inverse relation to the impact values.

In Fig. 5, the impact value and hardness curves of the SAE 640 steels show, like the tensile test curves, closely similar results for the two non-boron steels Nos. 7 and 8. No. 9, the Carbortam treated steel with low nickel, was very slightly tougher after tempering at 750 deg. or 900 deg. F., though no softer; but it was not quite so tough as the non-boron steels, as well as softer, after tempering at the higher temperatures. No. 10, the Carbortam treated steel with low molybdenum, was quite definitely superior in toughness to the other steels as well as softer, after all the tempering treatments. This agrees well with the tensile results.

Machinability Tests

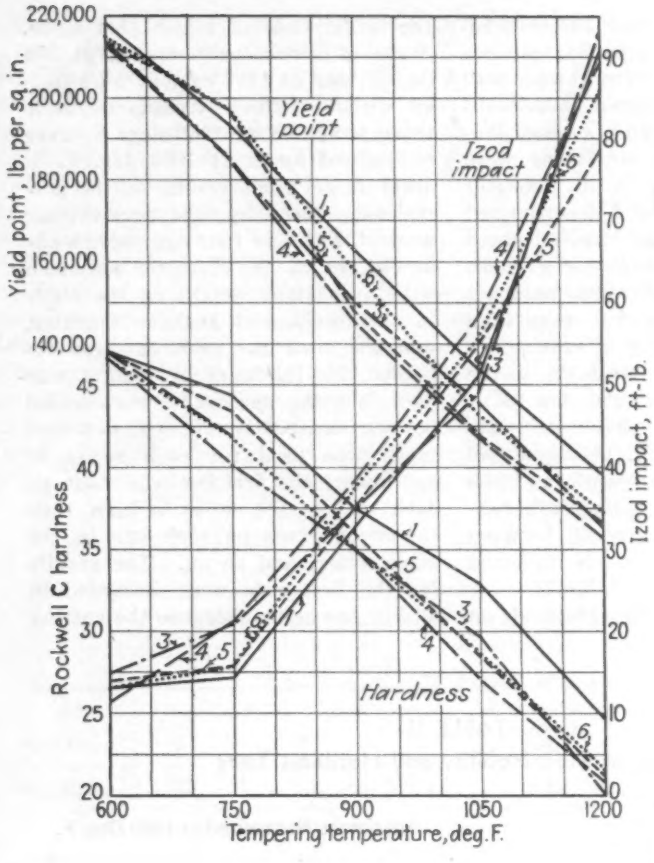
Two kinds of machining tests were made on these steels, one involving the measurement of the time required for removing a definite quantity of metal in a lathe, and the other the time required for cutting a section with a mechanical hacksaw. The former was applied to the normalized hardenability test specimens, using a small laboratory lathe. The specimens were first rough turned to ¾ in. diameter to remove the scale and decarburized surface, and then ten cuts of about 0.01 in. depth were taken for a length of ¾ in. on each specimen, reducing the diameter to somewhat more than ½ in. As the difficulty of cutting increases, this lathe slows down, so the cumulative time for the ten cuts, which was measured, should correlate with the machinability. The same tool was used for all the work and the edge was rubbed on a fine carborundum block, but not ground, between specimens. The results are reported in the sixth column of Table II.

The saw-cutting tests were made on the larger ends of tensile test stubs. Stubs of specimens tempered at 900 deg. F. and at 1200 deg. F. were tested without further treatment, while those tempered at 1050 deg. F. were normalized again at 1650 deg. F. in order to get some results on the normalized steels by the saw-cutting method. Three or four cuts were made across the ¾ in. diameter specimen with a constant weight on the blade in the mechanical hacksaw machine, and the time for each cut was recorded. No lubricant or coolant was used, but the specimens were cooled between consecutive cuts. A new saw blade was used for each series of specimens; the first cut was made on each steel of the series in turn, then the second cuts on each one in the same order, and so on. The results for the first cuts were discarded in all but one series, because the cutting

TABLE II
Results of Machinability and Hardness Tests

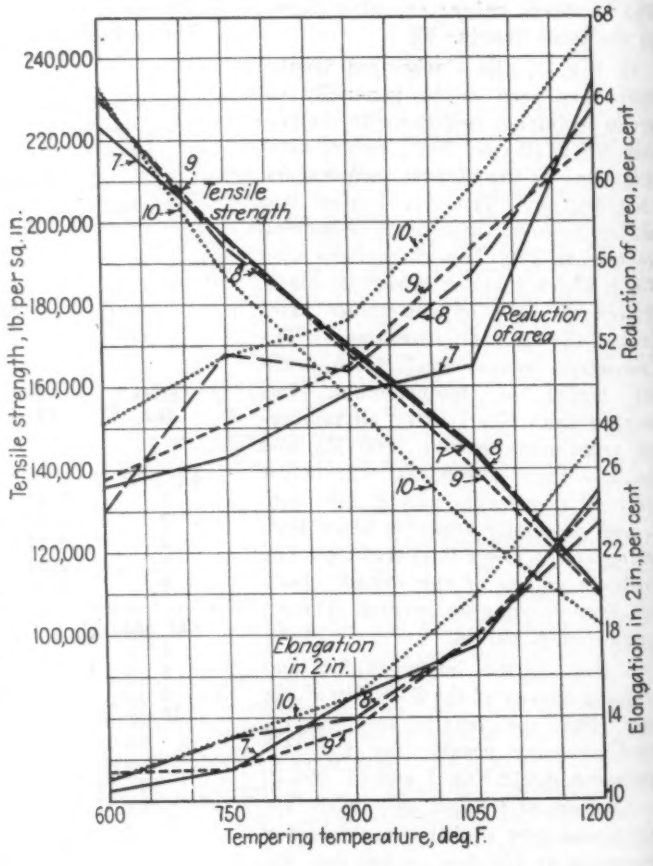
Steel No.	Analysis, Per Cent				Specimens Normalized at 1650 Deg. F.		
	Cr	Ni	Mo	B	Time, Minutes, For 10 Lathe Cuts of 0.01 In.	Average Time, Seconds, For Sawing ¾ In. Diameter	Average Rockwell B Hardness
NE 9440							
1	0.47	0.55	0.14	0.0004	12.43	49.3	105.5
3	0.09	0.48	0.11	0.0040	12.78	49.7	101.4
4	0.24	.....	.....	0.0030	12.77	46.0	94.8
5	0.53	.....	.....	0.0032	12.73	44.8	97.3
6	0.67	.....	0.01	0.0040	12.87	45.7	99.2
SAE 4640							
7	.....	1.56	0.30	0.0004	13.05	56.2	99.7
8	.....	1.79	0.23	0.0012	12.58	56.7	101.2
9	.....	0.60	0.25	0.0032	12.82	57.8	98.8
10	.....	1.54	0.07	0.0034	12.78	51.7	96.8

Steel No.	Specimens Oil Quenched from 1550 Deg. F.			
	Tempered 900 Deg. F.		Tempered 1200 Deg. F.	
	Average Time, Seconds, For Sawing ¾ In. Diameter	Average Rockwell C Hardness	Average Time, Seconds, For Sawing ¾ In. Diameter	Average Rockwell C Hardness
NE 9440				
1	55.3	37.5	85.0	24.7
3	54.3	35.0	83.0	20.0
4	54.5	35.2	84.5	20.8
5	54.0	36.0	82.0	21.2
6	55.0	35.0	84.3	21.7
SAE 4640				
7	57.7	38.3	74.7	22.2
8	59.0	38.5	76.2	22.2
9	56.3	38.2	76.5	21.0
10	60.0	33.0	83.7	17.7



LEFT

FIG. 3 — Variation of properties with tempering temperature in NE 9440 series, quenched in oil from 1550 deg. F.



RIGHT

FIG. 4 — Variation of tensile properties with tempering temperature, in SAE 4640 series, quenched in oil from 1550 deg. F.

time with the fresh saw-blade was not in good agreement with later values. In one series the results for the last cuts were disregarded, because those values were out of line with the others, the saw evidently having become dull. Otherwise the results for each steel were in good agreement between the various cuts. Average values, corrected for slight variations in specimen diameter, are reported in Table II, a lower figure representing better machinability. The Rockwell hardness of each steel in the same condition of heat treatment is also included in Table II.

The lathe-cutting tests as reported in the sixth column of Table II probably do not show any significant differences, although the result for steel No. 1 is a litle better than for the other NE 9440 steels, and No. 8 was a little better than the other SAE 4640 steels. The sawing tests also show only slight differences, the significance of which is doubtful. In general the harder specimens took longer to cut, and the softer specimens were cut more quickly, as might of course be expected, though there are some exceptions. One very noticeable exception is that all the quenched steels tempered at 1200 deg. F., though naturally softer than when tempered at 900 deg. F., were less easily machinable. The No. 1 steel was in general the most difficult to cut of the NE 9440 series, but it was also the hardest. The No. 5 steel, with boron replacing nickel and molybdenum, was the easiest to cut with a saw, and it was not the softest. Among the SAE 4640 steels, No. 10 with boron replacing molybdenum was the softest, and the most readily saw-cut in the normalized condition, but the least readily in the quenched and tempered condition.

All these differences in machinability were slight, however, and not of anywhere near the same magnitude as those found in saw-cutting the manganese steels with and without boron, discussed in THE IRON AGE article* referred to above. The sawing tests on those steels were unfortunately not completed in time to be incorporated in that article, but are summarized in the present Table III. The steel numbers here are identified by the letter M to indicate the manganese series, and to avoid confusion with the other series of this report. The tests were made in the same manner as those reported in Table II.

A remarkable difference in machinability between steels 10M and 2M, and the others is evident from the results reported in Table III. This difference was checked four times in the case of steel 10M, and does not seem to be accounted for by its hardness. Evidently the higher manganese and carbon combination in steels 10M and 2M gives much greater resistance to cutting with a saw, than when practically equal hardness is obtained with boron treatment and lower manganese, or with lower carbon as in steel 8M. In the lower carbon steels, sample 9M, boron treated, shows a slight superiority over the comparable non-boron but higher manganese sample 8M, since its cutting time is 5 sec. less though its average Rockwell C hardness is 2 points higher. Thus from these saw-cutting tests it appears that the boron treated steel have a definite advantage in machin-

ability over untreated higher manganese steels of about the same strength and hardness. Drilling tests of the same steels, however, did not show any difference that could not be explained by slight variations in hardness.

The improved cutting properties in sawing, found in the boron treated steels of the manganese series with about the same hardness and hardenability were not checked when boron was used in place of chromium, nickel, or molybdenum, where any advantage in machinability was comparatively negligible. The difference in the manganese series was evidently due to poor machinability of the quenched and tempered steels with more than 1.3 per cent manganese and 0.3 per cent carbon, rather than to any specific influence of boron on machinability. But it is consistently found in all the steels that when boron is used in place of other alloys to promote hardenability, the machinability is at least not impaired.

Discussion of Results

Summarizing the results that have been reported it appears that satisfactory hardenability is secured in NE 9440 steel without either chromium, or nickel and molybdenum (except for residuals obtained from scrap) if Carbortam treatment is used. In the SAE 4640 steel, the Carbortam treatment gives even better hardenability than 1.2 per cent nickel or 0.25 per cent molybdenum, but when molybdenum is saved in this way it should be remembered that the hardness at slower cooling rates is lower, and lower tempering temperatures are required for equal strength.

The tensile tests of oil quenched and tempered specimens showed but little difference between the regular NE9440 steel, and the steels with Carbortam treatment substituted for the chromium, or for the nickel and molybdenum. These Carbortam treated steels had a slight advantage in impact resistance, though not in hardness as oil-quenched and tempered. In the SAE 4640 steel there was no appreciable difference in tensile or impact properties of the quenched and tempered specimens when the Carbortam treatment was used in place of about 1.2 per cent nickel. When Carbortam was used instead of about 0.25 per cent molybdenum, however, the strength was lower and the ductility and impact values higher, at the same tempering temperatures. These differences are easily corrected as has been noted, by using a slightly lower tempering temperature for the Carbortam treated non-molybdenum steel.

In machinability no significant differences between the similarly heat treated steels, other than those to be expected from slight variations in hardness, were brought out by the tests.

The results of this investigation thus indicate that practically equal tensile properties, and at least as good, or in some instances even better, notched-bar impact resistance, are obtained in the quenched and tempered condition when treatment with Carbortam is substituted for chromium, molybdenum or nickel in NE 9440 or SAE 4640 steel. The hardenability and machinability of the steels are also not impaired by this substitution. The omission of molybdenum, however, may necessitate the use of slightly lower tempering temperatures for equal properties.

It is important that the correct amounts of other alloys are omitted when Carbortam is used, for it will not replace successfully unlimited amounts of other hardening agents, and if too much of the other hardening agents is present with the boron, excessive hardenability will result. This work indicates that enough Carbortam added to give 0.003 to 0.004 per cent boron in these laboratory melts successfully replaces about 0.6 per cent chromium, 1.2 per cent nickel, or 0.25 per cent molybdenum. This equivalent amount of chromium is higher than has previously been suggested, but those for nickel and molybdenum are in agreement with previous recommendations.

The important feature of this use of Carbortam is its economy as compared with the other alloys, as was pointed out in the previous IRON AGE article.* Adding 1.2 per cent nickel to steel increases the cost $6.24 per ton; 0.25 per cent molybdenum adds $4 per ton; 0.6 per cent chromium adds $2.40 to the steel cost per ton; but even 10 lb. of Carbortam per ton costs less than $1 and probably in large scale commercial practice less Carbortam would prove to be sufficient. The economy gained from the use of Carbortam in this way should be of considerable commercial importance especially since no loss in the useful properties of the steel need be incurred in taking advantage of it.

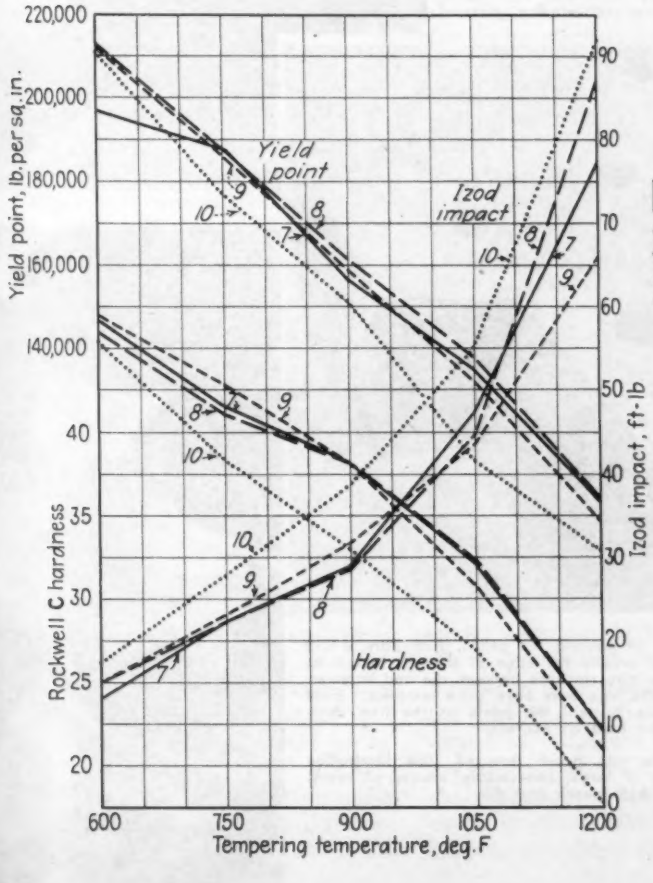


FIG. 5 — Variation of properties with tempering temperature, in SAE 4640 series, quenched in oil from 1550 deg. F.

Acknowledgments

The author is pleased to acknowledge the capable assistance of many friends on the staff of the Titanium Alloy Mfg. Co., who contributed materially to the completion of this investigation. Special thanks are due to J. R. Lewis and A. S. Yocco, who were responsible for making most of the specimens and tests, and to the company for supplying the necessary equipment and for permission to publish results.

New Type Lead-Zinc Drop Hammer Dies

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APPROXIMATELY a year ago, the foundry section of Lockheed, Plant A-2, was faced with steadily increasing demands for drop hammer forming tooling on one hand and rapidly decreasing manpower supply on the other. In order to cope with the situation, it was necessary that some new method be originated that would very drastically cut down on the necessary manhours per die.

The result was a radical departure from the accepted method of Kirksite die construction and the pouring of lead punches in these dies. The new method has resulted in a tremendous saving in manhours, and has made possible the meeting of greatly accelerated schedules with a very minimum of capable workmen.

The illustrations clearly show the difference between the old type of die construction which necessitated clamping asbestos lined boards around the die and sealing all joints with plaster or clay before a punch could be poured, and the new type die which is so constructed that the die itself confines the molten metal being poured for a punch.

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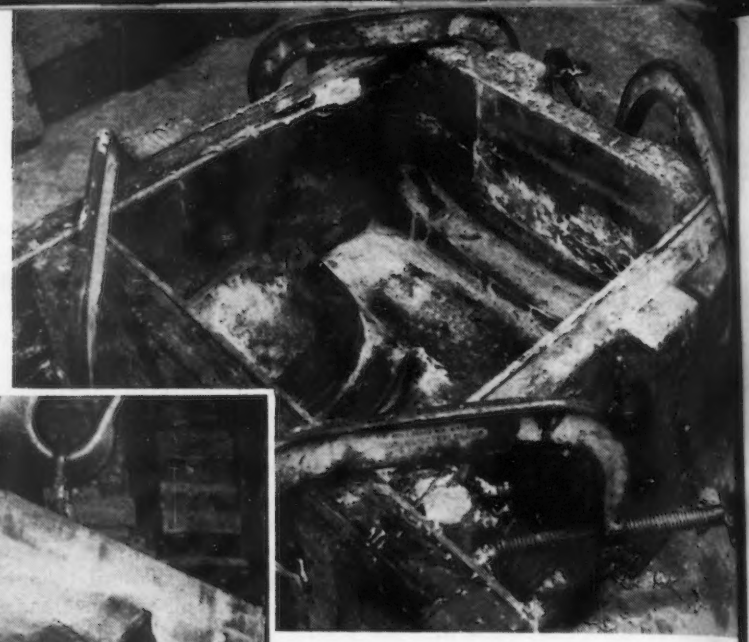

ABOVE: Conventional method of casting lead punches into Kirksite dies for drop hammer work utilizes dyke boards lined with asbestos and clamped in place as shown.

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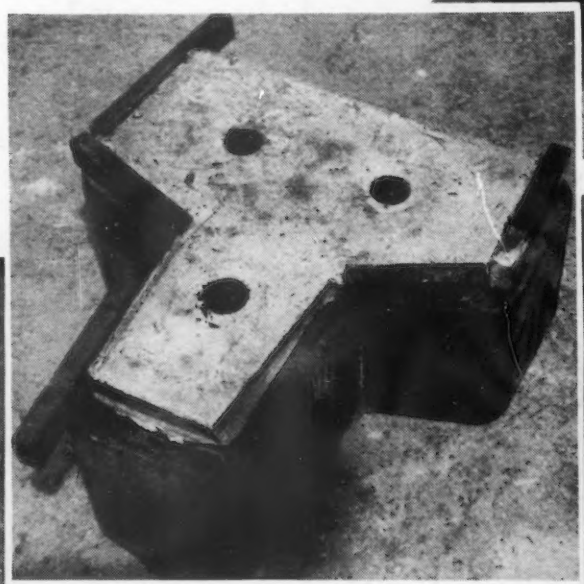
BELOW: New type Kirksite die ready for pouring of punch. Note the high retaining walls.

ABOVE: Old type die complete with punch, showing large mass of non-working metal.

BELOW: First stage of pouring the lead punch. The three holding studs have been located by a spider, not shown. The metal is poured flush with the top of the die.



ABOVE: Second stage of pouring the pnnch. Iron bars, 1 x 2 in. section, are placed around the edge of the die and 1 in. more lead is poured to give clarance between die and hammer. In this view some of the iron bars have been removed. Note that it is not necessary to seal the joints as the iron chills the lead on contact.

RIGHT: New type die with punch removed. This illustration clearly shows absence of large, unnecessary masses of metal in both punch and die.

Accurate Inspection Of Magnesium Alloy Castings

. . . Before any final conclusion can be drawn from the radiographic examination of castings, other pertinent factors must be considered. Herein is discussed the correlation of X-ray testing, metallographic inspection and subsequent operations that will eliminate peripheral defects.

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EXISTING specifications require the rejection of magnesium alloy castings which possess in the X-ray negative evidence of discontinuities of a localized stress raising type, such as cracks, cold shuts, misruns and extensive shrinkage voids.

On the other hand, discontinuities of a general type, not stress raising in nature, although undesirable, are not cause for rejection solely on the basis of X-ray inspection, but rather, their acceptance or rejection must be based on the results of the static test. Such defects are micro-shrinkage, gas porosity, blow holes and segregations.

Before attempting to illustrate an exact procedure, the following descriptive terminology is offered as pertinent to the subject being discussed.*

**Standard radiographic terminology approved by Committee E-7, ASTM, Committee on Radiography, American Foundrymen's Association and the Canadian Research Council.*

Stress cracks are fissures that usually are continuous throughout their length. Generally, they exist singly and terminate at the surface.

Micro-shrinkage, centerline weakness or interdendritic piping is shown as very small cavities occurring *between the individual grains*, and is usually found on the thermal centerline of the section. The radiographic appearance will vary from general mottling on the film to a tree-like group of inter-connected cavities.

The supplementing of metallographic studies to X-ray inspection seems indicated in certain classes of magnesium alloy castings, as a means for a more accurate interpretation of what actually exists in a given specimen and in the sense of conserving critical material, time and labor.

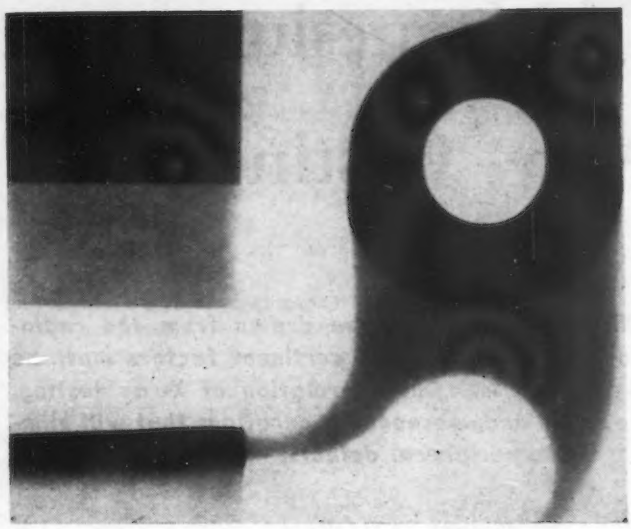
Although this study appears to impose some limitation on the absolute validity of some of the information obtained from the radiograph, it does not purport to discredit the X-ray inspector. In all justice it should be remembered that it is anything but a simple matter to view a radiograph and upon the information presented therein, state with absolute certainty that a certain discontinuity represents a crack, micro-shrinkage, or any of the other defects common to magnesium alloys when each in itself is, as a rule, minute in nature as illustrated on the X-ray negative. A great deal depends on the quality of the negative as affected by the technique chosen, the fineness in grain structure of the film being used and the general experience of the inspector. It would seem essential, however, that X-ray inspectors passing on the serviceability of magnesium alloy castings, first possess some knowledge of the peculiarities associated with the metal itself. Certain indications point toward the fact that even the highest quality radiograph is in itself rather inadequate for absolute accuracy in the interpretation of defects common to magnesium alloys.

Magnesium casting alloys possessing the best structural properties frequently develop a type of defect known as micro-shrinkage. This is, in effect, intergranular voids created by shrinkage of the last few per cent of the liquid alloy as it freezes. The extent to which the voids tend to occur depends on both the solidification shrinkage and on the temperature and range of solidification. The numerous magnesium alloys although having a lower than average value for solidification shrinkage have, as a group, a very wide range of temperatures over which solidification takes place, and it is the combination of these two properties which makes them so susceptible to micro-shrinkage.*

**"A Progress Report on Magnesium Casting Industry" Washington State Planning Council Project 43, published privately.*

Differentiation, radiographically, as to the type of defect that exists in a given casting may "occasionally" be made with reasonable accuracy, solely on the basis of information furnished by the X-ray film. This can be done by comparing the extent of the discontinuity, its outline, and general characteristics with the terminology referred to previously. However in this instance very close observance, with proper film density and proper illumination, is required of an experienced operator in order to arrive at any degree of accuracy. Therefore, as a supplement to X-ray inspection, metallography should be used to ascertain with absolute accuracy the nature of defects common to magnesium, when groups of castings are to be inspected and where a single type of defect seems persistent in one particular design.

As an aid to speedy fabrication for all material required in the shortest period of time consistent with quality standards, and to establish uniform



ABOVE

FIG. 2—Photograph of the casting shown in Fig. 1 showing failure along shaft after mechanical test. Bending of shaft may be noticed where failure took place while the highly stressed area containing the defect showed no signs of failure.

o o o

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FIG. 1—Radiograph of a casting showing defect.

standard for accurate subsurface inspection of magnesium alloy castings, which would be both fair to the consumer and foundryman alike, the following study was carried out on several magnesium alloy sand castings which were all rejected by X-ray inspection on the basis of possessing stress cracks. The castings represented a group returned to the fabricator as rejected on the above basis.

Upon return of the rejections they were re-radiographed in the foundry and upon evidence furnished by the radiographs were interpreted as possessing a certain amount of micro-shrinkage, but showing no evidence of any stress raising defects, such as stress cracks. That the castings were nonstructural in design would indicate by the information contained in the specifications that a permissible amount of micro-shrinkage would be allowable; but at any rate as mentioned in the specifications they would, on the basis of containing such micro-shrinkage, be subject to rejection only on the results of mechanical testing. The poorest of the lot that would not fail the mechanical test would be the basis for establishing a standard for that particular part.

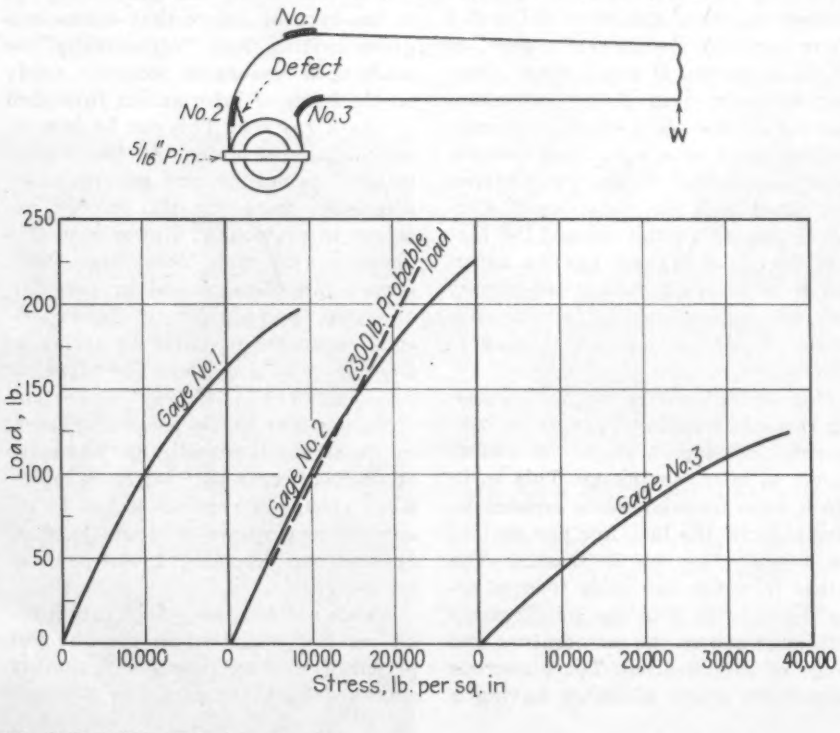
Having determined that micro-shrinkage existed, it was decided mechanically to test the specimen as a guide for future control in the foundry and with the hope of arriving at a definite standard for the casting in question. In so doing it was desired to establish also the exact identity of the defect which would most definitely cause early failure, if stress raising in nature.

A casting was selected, which had been radiographed in the foundry as one of the rejected parts, Fig. 1, for mechanical testing and subsequent metallographic examination. In this instance the casting was loaded as a cantilever, simulating the manner in which it would be installed in the airplane. A 5/16-in. pin was inserted through the 1-in. hole as shown in Fig. 2. Load was applied centrally along the axis of the lever. Initial signs of failure began to show at a load of 225 lb. along the shaft. No sign of failure appeared in the area containing the defect. Absolute failure was indicated at a 400-lb. load. At no time during the physical test was there any indication that the casting might fail in the area which contained the defect and the obvious conclusion was that, had a stress crack existed in the suspicious area the casting would have exhibited early failure, perhaps at not over 100 lb. load. The design load was 78 lb.

Illustrated in Fig. 3 are both a drawing of the casting and location of various test gages which were so placed as to record stresses in the most critical sections of the casting. Load was applied in compression and stresses plotted against pounds of load.

Following the mechanical test the casting was sectioned and prepared for metallographic study. Sections were examined through the area which contained the defect to ascertain further the identity of the void. The metallographic examination disclosed numerous small cavities *existing be-*

FIG. 3—This graph depicts the manner in which the casting was loaded. Stress gages were placed at the three most critical points where a stress raising defect would cause early failure. Stresses are plotted against the load in pounds.



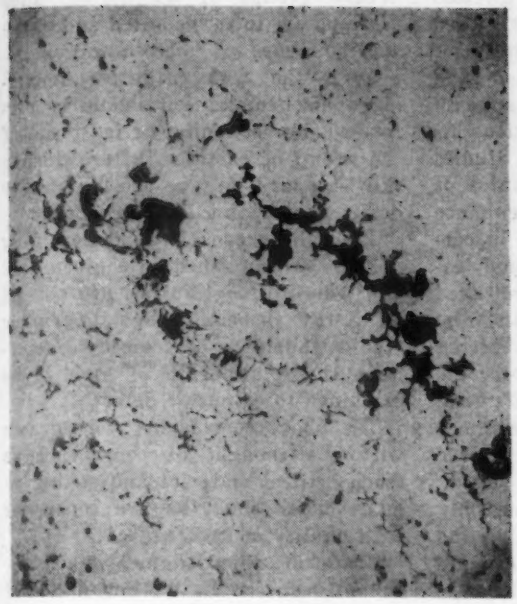


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FIG. 4 — Metallographic study performed on the tested and X-ray inspected casting, revealed small cavities existing between grain boundaries at 33 diameters.

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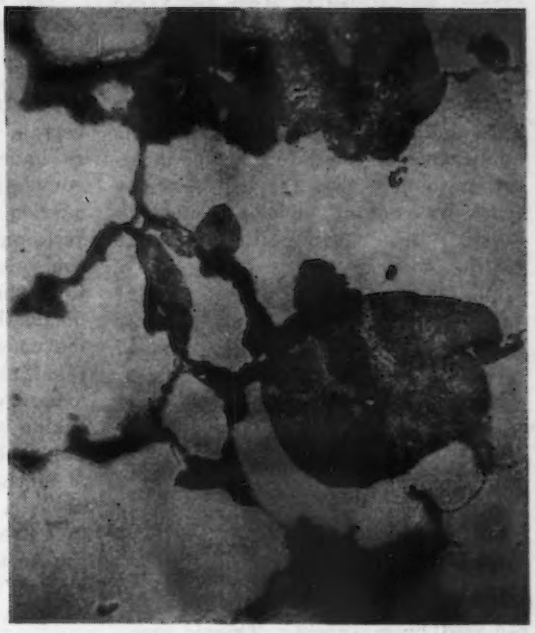
FIG. 5 — Same as Fig. 4 but at 200 diameters.



tween the individual grains. None of the fissures were continuous as may be seen by the metallographic illustrations in Figs. 4 and 5. From these studies it was concluded that micro-shrinkage existed in the area of suspicion and no evidence of stress cracks could be found.

Summary

(1) Radiographic interpretation rejecting the castings as possessing stress cracks was erroneous.

(2) The critical area of the casting was relatively sound since a stress raising defect would have caused early failure of the casting. A minimum of micro-shrinkage such as evidenced by results of the mechanical test interfere in no way with serviceability.

(3) Accurate typing of the defect was accomplished by metallographic examination which was in disagreement with the original interpretation based on X-ray inspection which rejected the casting.

To illustrate further the necessity for metallographic examination to supplement X-ray inspection, the following case shows that X-ray inspection performed prior to machining is wasteful.

Fig. 6 shows a magnesium alloy casting with a 1-in. hub and a relatively thin horizontal shell, such as would be designed for a control wheel. The dotted lines show the area that is to be machined out of the casting before its installation. As radiographed in the conventional manner, the casting would be so placed with respect to the X-ray film that the hub would be in a horizontal plane as would be the film placed beneath it. The area of stress would obviously be in the region where the thick hub joins the thin shell and somewhat above this location. The as-cast hub is cylindrical in contour. In more than one instance radiographs of the hub showed suspicious fine hairline cracks continuous in outline, but the depths of which could not be ascertained by X-ray inspection. (See Fig. 7.) The important point for consideration in this case is, that as illustrated in the X-ray film, in conformance with existing specifications, such fine hairline cracks are cause for rejection, solely on the basis of X-ray inspection. In many instances, they may not be cause for rejection if certain machine operations and other methods of testing are considered.

In the illustrated case there was some doubt as to the exact depth of the discontinuity and it was deemed advisable to have metallographic

RIGHT

FIG. 7—Radiograph of hub, illustrating crack, which on the basis of X-ray inspection would cause rejection. Since machining will remove the defect, the casting is sound.

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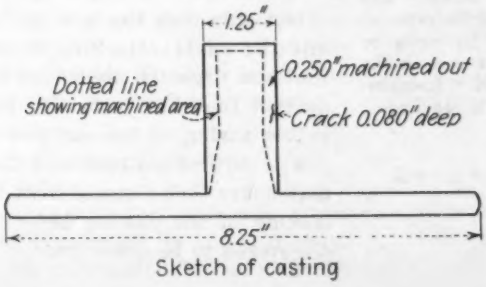
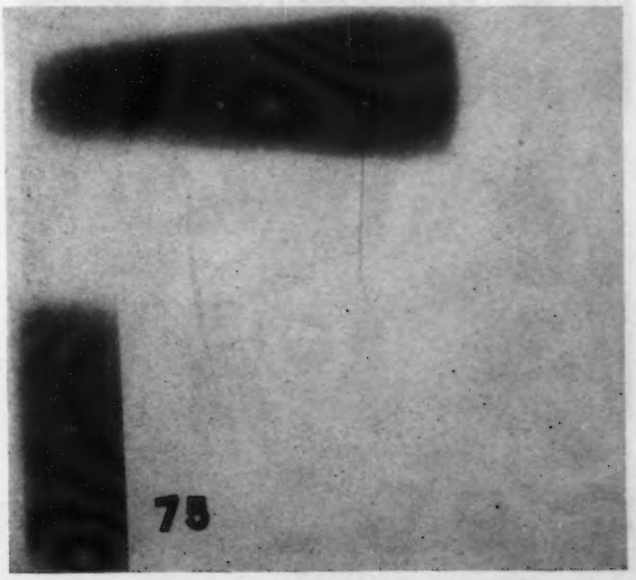
BELOW

FIG. 6—Drawing of control wheel casting with dotted lines to show area which will be machined off the part. The casting defect occurred outside of the remaining area.



Sketch of casting



studies performed to trace the crack to its termination and note the depth of such termination. In view of the fact that 0.250 in. was to be machined out of the casting on each side of the hub, and because of the radiographic appearance of the defect it was interesting to note that the depth of the crack was not of sufficient extent to impair the serviceability of the casting.

The metallographic studies showed definite disappearance of any sign of the defect at a depth of 0.80 in. Therefore, after the area was machined out, as called for in the drawing, a perfectly sound casting would result.

In view of the findings illustrated, and other experiences which occurred prior to the current study, it is felt that metallographic examination should be supplemented by X-ray inspection, when certain areas are to be removed by machining. This is especially applicable in the case of magnesium alloy castings where fine cracks and similar defects of a minute nature are present and are illustrated in the X-ray film.

(1) The continued use of X-ray inspection as the sole basis for rejection of magnesium alloy castings, when carried out on a large scale and prior to metallographic examination and certain machining operations, appears to have very definite limitations as conventionally practiced today. Studies carried out to determine the value of sectional radiography may enhance the value of X-ray inspection in certain specific cases. In sectional radiography, a synchronized coordinated movement of the X-ray tube and film takes place about a fixed axis during exposure. This method permits the taking of a section or layer of metal at a predetermined depth, blurring out of focus the superimposed surface above a defect and also the subsurface area below the defect. Thus only the area of interest is shown on the film. With proper fulcrum arrangement on the X-day tube and film support the depth of a defect can be measured in centimeters and accurate depth localizations made.

(2) Metallography as supplemented to X-ray inspection offers a quantitative analysis in the typing of discontinuities common to magnesium alloys. Where groups of magnesium alloy castings are to be inspected and where specific types of discontinuities appear in the X-ray negatives, metallographic examination should be performed, by sectioning at least one of the group of castings, after which a fair standard may be set for similar designs containing similar defects.

(3) Where considerable machining is to be accomplished on a given part and where discontinuities are noticed on X-ray inspection, metallographic studies should be performed to determine the relationship of area to be machined to extent of defect.

The above conclusions were drawn with the thought of conserving as much critical material and saving as many labor hours as are consistent with quality control.

Grateful acknowledgment is extended to Professor F. W. Schonfeld, of the Department of Mining and Metallurgy, State College of Washington, who carried out the metallographic studies. This project was sponsored by the Engineering and Experiment Station.

Defective Aluminum Castings Repaired by Welding

A LARGE percentage of the aluminum turret castings that previously had to be rejected because of porosity and hollow spots are now being repaired at the Glenn L. Martin Co., Baltimore, by a new process evolved by Louis Barrett, tool design process engineer, in which the porous material is replaced with welding metal.

Under the new process the surface defects in the casting are first removed by grinding or chipping out the porous material. The casting is then pre-heated to 200 deg. to 300 deg. F. either in a furnace or by application of local heat. Next the cavity is welded or filled with weld metal using a carbon arc and a 5 per cent silicon "Aluminum Weld" welding rod. Finally the welds are carefully cleaned and filed smooth, and the area covered by the weld is neutralized.

The outstanding features of the new process are the pre-heating of the casting and the use of a carbon electrode in combination with the metal welding rod. The pre-heating simplifies the welding operation and lessens the possibility of cracks by lowering the temperature differential between the point of the weld and the surrounding metal. High heat at the point of weld is avoided. The use of the carbon electrode with a normal metal welding rod provides a better adhesion between the weld metal and the aluminum casting than when the metal welding rod is used by itself as an electrode.

The new method of repairing defective castings is limited in use to low-stressed areas. Porosity or hollow spots are determined by X-ray and following the welding, the casting is again X-rayed to insure a perfect blend between the weld metal and the casting.

Not only does the new method permit the rapid salvaging of castings that are urgently needed on the production line, but it is also resulting in the saving of considerable quantities of critical materal, and the many man-hours that already went into the making of the casting before it was discovered to be defective.

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AFTER the porous material has been removed by chipping or grinding, the area surrounding the cavity to be welded is preheated to 200 deg. to 300 deg. F. with a torch. A second man (in this picture Louis Barrett who devised the process) stands by ready to weld as soon as the required temperature is reached.

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THE JOINING OF METAL

By J. AHERNE-HERON and L. N. SMITH, M.A.

RECENT progress in developing nonmetallic adhesives for joining metals, such as "Redux" and "Cycleweld,"* has stimulated interest in the whole problem of joining, although it is felt that this interest could well be extended to wider circles, according to an article in the British magazine, *Aircraft Engineering*.

**For data on these adhesives, see* THE IRON AGE, *Aug.* 19, 1943, *p.* 52.

Even today it is not generally realized that on air frames, joining forms the largest single item in the construction, and, therefore, in addition to other technical drawbacks of current methods, the economic importance of improved joining is one of the first order. In certain categories wooden airplanes have always been cheaper to produce because of the ease of joining compared with that of light alloys, but if strides could be made in metal joining then the whole problem would be put on an entirely different footing.

For many years the aircraft industry (by far the greatest user of light alloys to date) has been struggling along with the primitive method of inserting pegs into holes and burring over the ends of these pegs in order to make a joint. This, which in the earlier days was an improvement on the previous system of tying wooden members together with grass rope, is a highly inefficient and costly method of joining. When applied to modern methods of stressed skin construction, in particular, it gives little or no stability to the sheet as it is an extremely local form of attachment.

In order to demonstrate the inefficiency of present methods Fig. 1 shows various methods of joining light alloys compared with each other. This is illustrated by the widths of the joints which are of equal strength to the 2-in. strip of parent material running down the center of the figure.

Also in this figure will be seen two graphs which illustrate the percentage increase in weight compared with the weight of the basic 2-in. strip, and a series of efficiency figures based on the comparison of a hypothetical 100 per cent joint with the increase in width necessary to obtain equivalent strength to such an "ideal" joint with present methods.

From what has already been said it will be seen that present techniques are highly inefficient compared with what engineers would like to demand of a joint. What would be the characteristics which would be desired of a really good joint? It would be considerably stronger than at present, a joint which gives stability to the sheets being put together, fewer excrescences than there are now, much better continuity and improved stress distribution. The joint would also have to be free from vices; that is to say, easy to apply, not affected by a normal range of temperature variations and not subject to rapid deterioration in ordinary working conditions.

If these qualities were only achieved to a limited extent, it would mean, in the case of stressed skin construction, greatly improved stability and secondary failures would be delayed. If, on the other hand, really great strides could be made along these lines towards a 100 per cent joint, then it would revolutionize not only joining, but also the whole present practice of engineering construction.

Already, with the new type of wing sections which are being developed, requiring close tolerances, great improvements in joining sheet are becoming urgently necessary. It is true that other forms of joining beside riveting exist, but in most cases they present greater complications and lower strength values. One of the most promising to date is electric spot welding, but it is felt that the cost of the plant, its high losses, its nonportability and the restrictions it places on the designers are always likely to present most serious drawbacks. Torch welding of aluminum alloys is also unsatisfactory in stressed structures, especially when it is necessary to heat treat the joint to obtain any

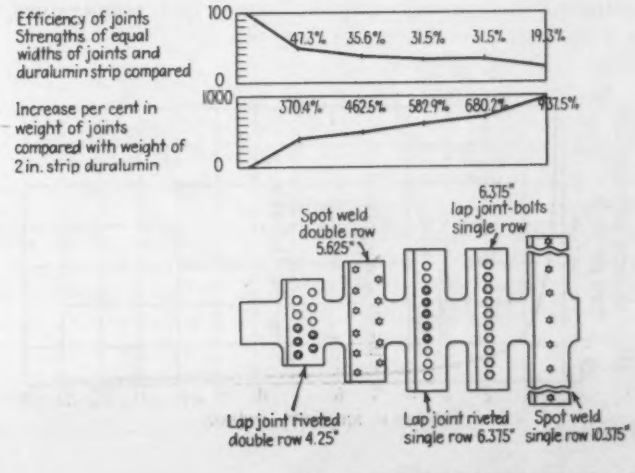


FIG. 1 — Relative efficiencies of various methods of joining duralumin strip, 2 in. wide and 14 gage.

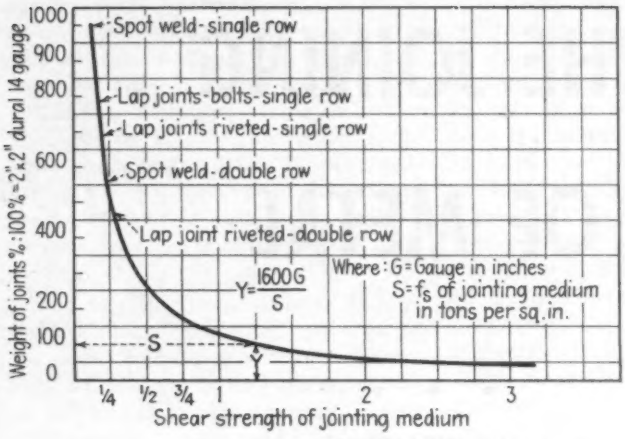


FIG. 2—Effect of shear strength of joining medium on weight of joint. Material is 2-in. wide duralumin strip of 14 gage.

reasonable properties. Also, of course, many of the standard sheet alloys cannot be welded at all.

It is important to stress that the present state of affairs, in which the immediate demands of designers have gone so far ahead of the development of jointing processes, has largely come about because of the failure of the light alloy users themselves to impress upon the material manufacturers the urgency and acuteness of the problem. Indeed even now, some of the light alloy manufacturers are not deeply aware that the problem really exists at all.

In making suggestions as to the possible lines of development which can be pursued, it is felt that the joining of light alloys has ceased to be an engineering problem pure and simple, and whoever investigates it must approach it from a different angle. The failure to appreciate this fundamental fact is proved by the large amount of money and effort that is still being put into improving the rivet, making it hollow or quickly insertable and so on, rather than seriously getting down to a new approach in order to evolve a new type of joining. It is, therefore, felt that something basically new must be developed, not so much by the engineer, but rather by the metallurgist or the chemist.

In Fig. 3 will be seen the shear strength required of a medium to compete with existing forms of jointing. This illustrates that a medium giving only 672 lb. per sq. in. shear strength would compete with all existing forms of jointing. Provided such a jointing medium had a reasonable tensile strength, no vices, and could be applied readily, it would not matter whether it was in the form of a thin foil or in the form of a dipper solder or sprayed coating but it should be bonded by a pressure which could be applied at a temperature below that which will affect the heat treatment of the alloy, or cause distortion.

Given such a joining medium it is felt that the engineer will always find a method of applying it; but it must be remembered that the joint in most structural applications must be as positive as possible, otherwise it permits too much deflection. It is hoped that eventually a 100 per cent joint will be obtained, but if only something new could be started having such low properties as are indicated above it would in due course lead towards this ideal.

It is known that a perfect bond can be obtained by subjecting two pieces of metal (the surfaces of which have been made completely oxide free) to the correct combination of pressure and temperature, these two factors varying inversely. This method of bonding is used in a well-known extrusion process. A recent explanation of this form of joint is that heat increases the range of atomic movement and, when pressure is applied to the surfaces, inter-recrystallization takes place, due to the atomic exchange between the two surfaces.

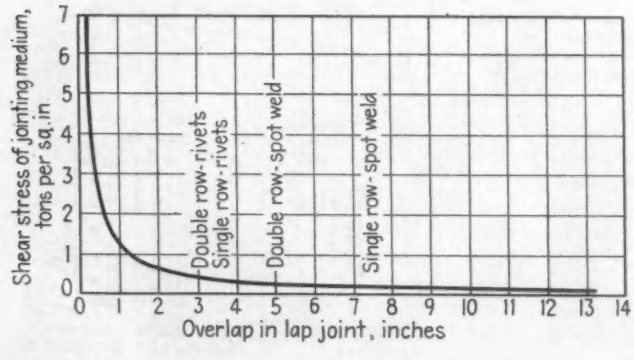


FIG. 3—Shear strength required to compete with existing forms of joint. Material is 2-in. wide duralumin strip of 14 gage.

The possibilities that would be opened up by the 100 per cent joint are too numerous to mention, for it will be seen that any mass having projections formed on it at present by forging or machining, would be greatly simplified by making the major part of the body separately and attaching these frailer members on to this body. For example the manufacture of an impeller would be enormously simplified if the circular base could be made independently and the vanes added afterwards.

In conclusion, there are the following possibilities for developing new forms of jointing which would well repay investigation.

(1) A chemical (that is, to put it more crudely, a glue) which can be applied easily, has no vices, and has a shear strength with an equivalent tensile strength of only 560 lb. per sq. in. The "Redux" and the "Cycleweld" processes come into this category, and while they are an advance on previous jointing means, it is believed that they are still difficult to apply and, in the case of the "Redux" process, a considerable decrease in strength occurs at even relatively low temperatures.

(2) A metallic bond comprising a metal layer, for example solder in the form of thin foil or a sprayed coating, which can be applied and treated within the temperature range which will not affect the properties of the alloys. Any increase on 560 lb. per sq. in. would be a considerable improvement over existing types of joints.

(3) The possibility of a 100 per cent joint by intercrystallization in order to obtain complete fusion at low temperatures. Such a form of jointing would open up entirely new methods of manufacture.

The above comments and suggestions are put forward in the hope that they will stimulate discussion and healthy controversy. They do not claim to be a detailed program of action. That is for the experts in the respective fields to draw up. But if they serve to give a perspective of the importance of this problem, and to stimulate discussion, then they will have accomplished their purpose.

Three Dimensional Drawings

Speeded by Photographic Method

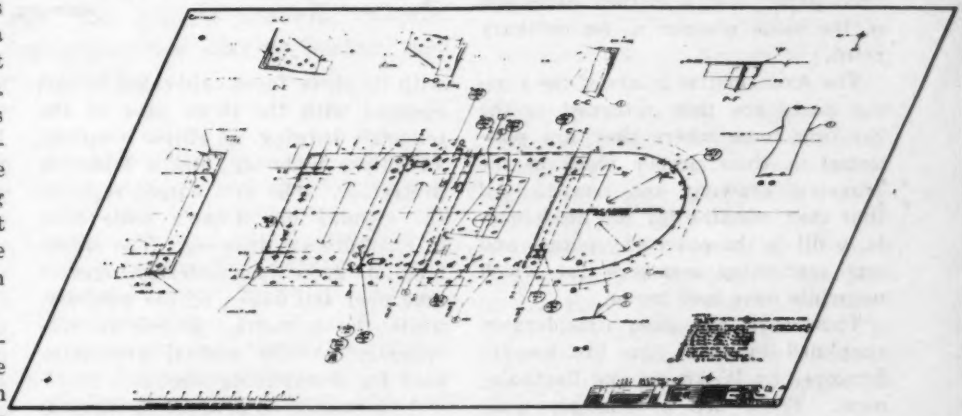
MANY plants have established an auxiliary drafting department to make three dimensional renditions from orthographic projections for the use of their help doing assembly work, many of whom never have had experience in reading blueprints. Now, to make work easier for the draftsmen who make work easier for the assemblers, a new machine has been developed that takes advantage of certain trick effects possible with the camera. The idea is to have the camera shoot a straight flat engineering drawing at an angle. The print is used by the draftsman as one of the planes for the three dimensional drawing. He then fills in the other two dimensions or faces, saving by this process from 50 to 80 per cent of the time normally required to make the perspective type drawing from scratch.

A machine developed by W. G. Wilkinson and H. C. Bartholomew of the engineering department of the Glenn L. Martin Co., Baltimore, adds certain refinements and time saving steps to the above principle, and is known as the Martin Axonograph. By adjusting the machine and the position of the print on the copy board according to a predetermined scale, it is possible to produce the resulting print in any one of the three trimetric planes —plan, face or side—to fit the needs of each particular job. Likewise, it is possible to vary the scale as required while maintaining accuracy.

Fig. 1 shows what a flat drawing looks like after it has been photographed at an angle; Fig. 2 shows the finished trimetric (or three dimensional) drawing. The component parts in the latter drawing occupy relatively the precise same locations as the parts do in the flat drawing.

The procedure for preparing a trimetric drawing by means of the Axonograph can best be illustrated by a typical example such as an airplane fuselage. The scale desired on the finished drawing is first determined, and the drawing is broken down into its various component parts such as the bulkheads. The negatives from which the lofting templates of these various parts were made are then sent down to the Axonograph department with instructions as to scale and the principal plane in which each part will appear on the finished trimetric.

The former depends on the scale of the finished drawing and the scales of the drawings from which the Axonograph prints are to be made. If all prints are to be the same scale, only one Axonograph setting is required, but if the original drawings are to different scales, the machine can be adjusted to compensate for this and produce prints all to one scale.



ABOVE

FIG. 1—Example of a print made by the machine from an orthographic type drawing.

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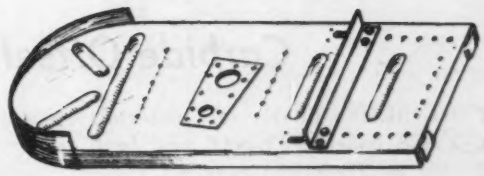

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FIG. 2—The finished trimetric print traced from the print in Fig. 1 with added dimensions filled in by hand.

The plane in which the print is to be made is determined by the nature of the part and its position in relation to the position of the finished drawing. Thus, in the case of a fuselage, if the finished trimetric projection is to show it in a position corresponding to a three-quarter rear view, Axonometric prints of the bulkheads would be made in the face plane, but prints of a top hatch would be made in the plan plane, while those of a side hatch would be made in the side plane.

The actual making of the Axonograph prints is a mechanical operation which can be performed by a semi-skilled operator thus effecting still another saving. The machine, shown in Fig. 3, consists of a moving copy board which holds the drawing to be photographed and is adjustable in its angle of slant, an adjustable device for setting the position of the copy on the board, an electric motor to move the board forward and back, a camera for recording the axonometric projection, a funnel which moves vertically and restricts the camera's view to a narrow slot in the end, a 3000-watt light tube to illuminate the negative, a stand which supports the rolling fulcrum of the funnel and a movable stand which supports the camera.

The negative of the drawing to be projected is placed on the glass surface of the copy board supported on two sides by the positioning device which can be rotated according to a scale on its outer perimeter. While the negative is in the horizontal position, the copy board is placed at the proper angle for the plane desired, and the camera is moved backward or forward to provide the required scale. Since horizontal lines are projected in true proportion, as long as the negative is a horizontal position, the scale can be determined by measuring directly on the ground glass of the camera.

After the camera is placed and focussed, the negative is positioned

on the copy board by rotating the position adjusting device. As in the case of the slant of the copy board, the negative is positioned on the board at a predetermined angle from the horizontal, depending on the plane in which the projection is being made. Following positioning of the negative, the camera is loaded with ordinary photographic printing paper and the machine is placed in operation.

As the copy board moves forward and backward, the funnel raises and lowers permitting the camera to record only that portion of the negative which is intersecting a plane parallel to the plane of the camera at any given moment. In this way, it scans the entire drawing and records the axonometric projection on the sensitized paper, which is then developed in the same manner as an ordinary print.

The Axonometric prints of the various parts are then returned to the drafting room where they are positioned in their proper place in the trimetric drawing and traced. All that then remains for the draftsman is to fill in the other two planes and any connecting members for which no prints have been made.

This work has been considerably simplified by four new instruments developed by Wilkinson and Bartholomew. These are a trimetric scale with its three faces calibrated to correspond with the three axes of the trimetric drawing, an ellipse template, an ellipse underlay, and a trimetric protractor. The first named replaces the regular draftsman's scale used in conventional drawing. The ellipse template and ellipse underlay together take over the duties of the compass, while the trimetric protractor corresponds to the normal protractor used for determining angles.

As a method of production illustration, trimetric drawing has proven superior to other systems at the Glenn L. Martin Company. The development versions of the Martin Axonograph and the new trimetric instruments have been used experimentally and have been found invaluable in simplifying and speeding up the construction of these drawings. They are now being used extensively in the preparation of drawings for the JRM-1 Mars, the first Martin production airplane.

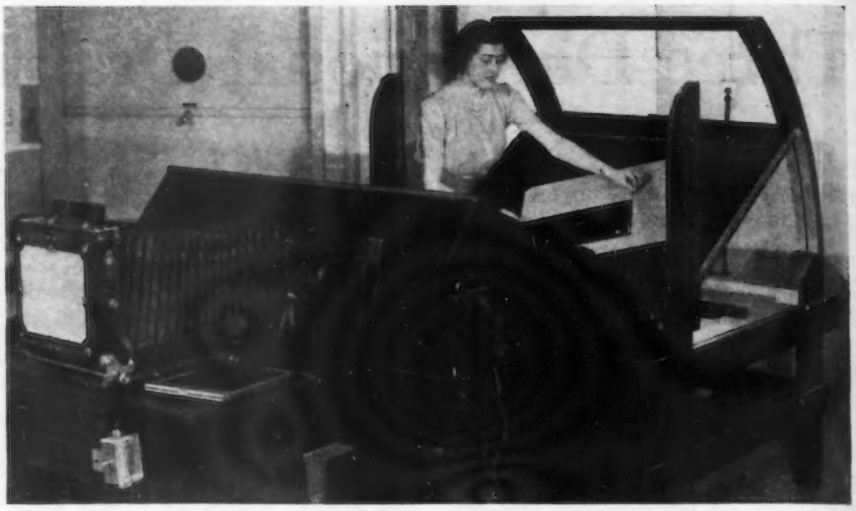
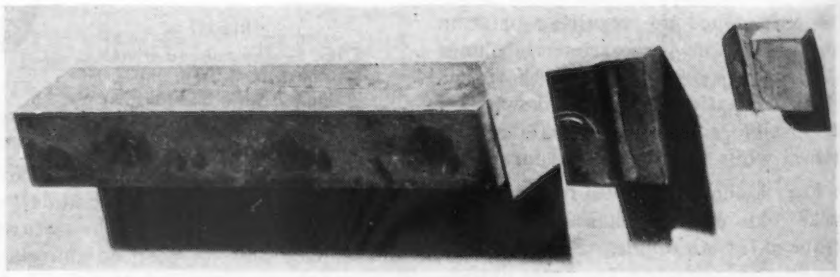


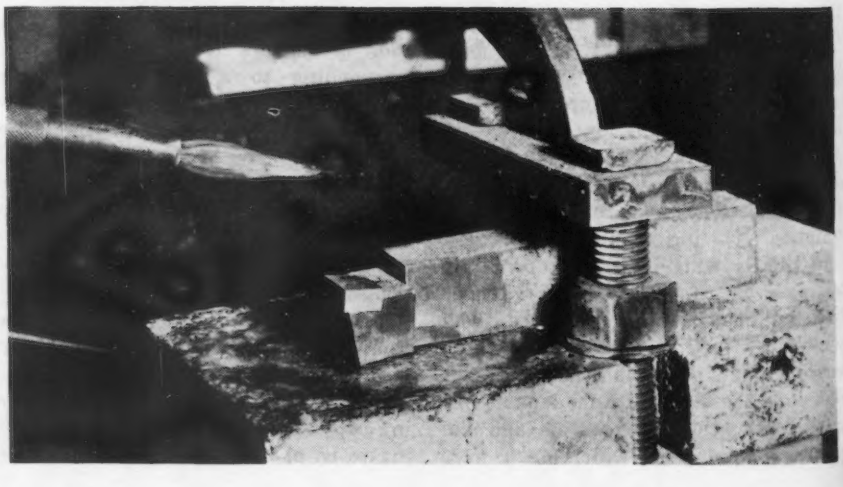
FIG. 3—Employee adjusting template on the copy board. In the center is the scanning funnel.

Carbide Offset Tools With Composite Shank

CONSERVATION of materials and machine hours has been effected by Thompson Aircraft Products Co. of Euclid, Ohio, by an unconventional method of making offset type Carboloy cemented carbide tools. Instead of using a forged steel shank or milling out a square shank to produce the offset, such tools are now fabricated from three separate pieces —a head, a shank, and the cemented carbide tip. Both head and shank are of cast Meehanite for all types ¾ in. or larger. The various parts going into the assembly are shown above, including two sections of Easy-Flo No. 3 sheet, the brazing metal used in the operation.

The head is cast with a step recess ready to receive the tip, thus eliminating a milling operation. The carbide tip can be placed on either the right or the left side of the head and the head itself can be used for either right or left hand offsets. To torch braze the two secions of shank and the carbide cutting tip, the parts are assembled and the shank clamped in a vise as shown below.





Electroplaters Discuss Industrial Finishing Methods

. . . In this, the second part of a three-section report on technical papers presented before the 32nd annual conference of the American Electroplaters' Society, attention is directed to gas induced defects in electroplated coatings, the Iridite process, colored chromic acid anodic coatings, techniques for plating indium, and bright alloy plating.

"THE Relation of Defects in Electroplate to the Gas Content of the Basis Metal" was described by Carl A. Zapffe and Charles L. Faust; formerly research metallurgist, Battelle Memorial Institute, Columbus, Ohio, now assistant technical director, Rustless Iron & Steel Corp., Baltimore, and assistant supervisor, Electrochemistry Division, Battelle Memorial Institute, respectively.

Gas-caused defects in electroplated coatings such as embrittlement, blistering, nonadherence, and pitting were examined from the standpoint that these may be produced by gas issuing from the basis metal. Usually only electro-deposited hydrogen has been considered, especially in the case of gas pits and embrittlement.

The so-called "aging" of electroplate is shown really to be a double phenomenon involving both the plate and the basis metal. A brittle plate thus may age into ductility by losing its hydrogen into the atmosphere; whereas a ductile plate may actually "age" into brittleness when the same dehydrogenizing action occurring in the underlying metal throws a detrimental quantity of that gas into the overlying plate.

In the same manner for gas pitting, those gas bubbles on the cathode often described as "unusually adherent" are in reality the result of gas issuing, not from the electrolyte, but from the basis metal.

The authors outlined experiments on (1) Embrittlement: Brittleness from the formation of metal hydrides; the time factor in embrittlement; immediate brittleness from co-deposition of hydrogen; delayed brittleness from hydrogen leaving the basis metal. (2) Blistering and Adherence: Time, temperature, and H content as factors; the purity of the basis metal as a factor; an observation or beryllium-copper alloy; pitting.

The Iridite Process

THE Iridite process was described by Albert G. Taylor, Rheem Mfg. Co., Baltimore. This process, by forming a continuous, integrated surface film of chrome gel, so inhibits and retards the tendency of the zinc or cadmium to undergo solution that the life of the coating is greatly prolonged. This film falls within that very general classification known as chromate dip coatings. After a brief immersion in the bath and subsequent rinsing and drying, the finished product is covered with an opaque, olive drab coating.

A bright, highly polished plate over a smooth steel base will result in a smooth and shiny coating, and vice versa. Similarly, impurities in the metallic zinc or cadmium base, when present in appreciable amounts, will have an effect on the nature or color of the coating produced.

Chromatizing dip coatings are a relatively old art. In the control of the secondary reactions to give a specific result lies the difference between Iridite and other chrome dip coatings.

The principle of the control of the secondary reactions has been utilized in the preparation of a second Iridite bath which produces a jet black finish. Where corrosion resistance is the major factor and color is secondary the olive drab coating is still to be recommended. In the black Iridite, however, a large part of the corrosion resistant coating is maintained, and tests give upward from 100 hr. in the salt spray cabinet before white corrosion products appear.

This black coating is obtained by introducing into the Iridite film a coprecipitated chemical compound which, in a separate dip bath, is preferentially colored.

During the formation of the coating a certain amount of the base metal goes into solution, estimated between 0.00002 and 0.00004 in. The coating so nearly replaces the metal removed that dimensional changes are negligible.

No great amount of abrasion resistance can be claimed for Iridite. Due to the gel structure of Iridite, exposure to high temperature results in a graduated dehydration. This results in progressive deterioration in corrosion resistance when the coating is exposed, for extended periods of time, to temperatures of 200 deg. F. or above.

In general, the average of many salt spray test results from varied sources would give a figure between 300 and 400 hr. A conservative figure of 200 hr. may be taken as the average expectancy. This figure is based on the first appearance of the white corrosion product.

Exposure tests to determine the value of Iridite as a paint base were started some time ago. The results so far have been good and without exception, far superior to those obtained from painting directly over a plain zinc surface.

The concentrated chemicals from which the bath is prepared are shipped in units of two carboys. For use, one part from each carboy is mixed with eight parts of water. Suitable facilities are necessary to assure that the work entering the Iridite bath be reasonably free from dirt, grease or zinc corrosion products.

Such installations are generally part of the normal plating setup which proceeds the Iriditing. Drag-over of the alkaline solutions from the plating bath should be eliminated by two fresh water rinses following the zinc plating. The Iriditing proper calls for a tank to hold the Iridite solution, two water rinse tanks with facilities for heating the second tank and some method of drying. The Iridite tank is preferably acid-proof-brick lined. Steel tanks lined with one of the several synthetic materials available for this purpose are suitable. In small operations porcelain crocks can be utilized. The wash tanks can be made from steel or wood.

Drying is accomplished by blowing off with air, passing the parts through a warm air tunnel, by centrifuge on small parts, or by any other means suitable to production needs.

The Iridite coat forms in 15 to 30 sec. depending on the age and temperature of the solution. Where production requirements necessitate longer immersion times, the solution may be diluted to effect a satisfactory coating in a longer treatment time. The work should be removed as soon as possible after complete coverage of the zinc surface. The solution is worked at room temperature. At temperatures below 65 the reaction takes place too slowly, and with freshly mixed solution, above 95 deg., too rapidly. After the coating is formed, it is given a cold water rinse, followed by a warm water rinse, 120 deg. to 150 deg. F. for not too long a time. After the final rinse the work is dried and is then immediately ready to box and ship. The complete Iriditing cycle is from two to 10 min., depending on the facilities for drying.

Pre-Treatment for Die Castings

Die castings, and particularly small parts which can be barrel plated, should have a flash plate of zinc followed by the regular Iridite procedure. If this is impossible, due to lack of plating facilities, most die castings are amenable to Iriditing after a pre-treatment in hot caustic soda.

The action of the Iridite bath on galvanized coatings is such as to accentuate the spangle. For this work a special bath containing a somewhat higher chrome content is advantageous. The results obtained depend a good deal upon the perfection of the galvanizing.

In most installations it is best to run the bath to depletion, to be followed by total replacement of the bath. Where this is impractical, replacement can be accomplished by addition of concentrated solutions representing a certain percentage of the total bath volume. In adding the concentrates, the ratio of the components is kept constant.

The Iridite bath operates through a pH range of 1.5 to 3.4. The coverage on plated parts has been reported as between 15,000 and 22,000 sq. ft. per 125 gal. of mixed Iridite.

Rapid Determination of Copper in Nickel Baths

B. B. KNAPP, International Nickel Co., Inc., Research Laboratory, Bayonne, N. J., read a paper on "A Rapid Determination of Copper in Nickel Plating Baths."

Dithizone, which is known chemically as diphenylthiocarbazone, is an organic reagent which reacts quantitatively with a number of metal ions forming colored compounds. Most of these compounds, which are called dithizonates, and dithizone itself are insoluble in water but are very soluble in carbon tetrachloride or chloroform. The reaction between the metal in the aqueous solution and the dithizone is brought about by simply shaking the aqueous solution with a solution of dithizone in carbon tetrachloride. In that way copper, for example, may be extracted from an aqueous solution into the carbon tetrachloride layer as copper dithizonate. Dithizone is not a specific reagent but under specific conditions it reacts with only certain metals or groups of metals. In the pH range of 1.3 to 2.3, the metal ions that interfere with copper are stannous tin, bismuth, silver, mercury, gold, platinum and palladium. None of these elements is ordinarily found in commercial nickel plating baths so that their interference in the copper determination is unlikely. A method of removing these interfering ions has been reported and it consists of shaking the dithizone extract in carbon tetrachloride with an acidified potassium iodide solution. The presence of these interfering ions can be detected by the off colors that they give when mixed with the copper dithizonate.

The dithizone reagent may be used in three ways: Gravimetrically, volumetrically or colorimetrically. The first method tried in this work embodied the principles of a titrimetric extraction procedure. This is a thoroughly good method but it is too slow and involves too much shaking. A simpler method was devised using the mixed color principle. This only involves shaking a sample of the plating bath with the reagent and matching its color with a set of standards. This reaction of copper with dithizone lends itself readily to a colorimetric scheme because the dithizone solution in carbon tetrachloride is a bright green color and its reaction product, copper dithizonate, is a dark red color. In the mixed color method the determination is made with a slight excess of dithizone so that the resulting color will be determined by the relative amounts of green dithizone and red copper dithizonate. The color then may vary from green to red with intermediate blues and purples. This color of the unknown can readily be matched with a set of standards to obtain the amount of copper in the unknown.

Colored Chromic Acid Anodic Coatings

"DYED Anodic Coatings on Aluminum Produced by the Chromic Acid Process" were detailed by L. G. Tubbs, Mutual Chemical Co. of America.

Colored and black dyed chromic acid anodic coatings on aluminum are finding application in the manufacture of aircraft motors, instruments, binoculars, etc. This report described how these finishes may be obtained and indicated the effect of certain variables. Results with a number of dyes were included.

The general operations for producing black and colored anodic coatings are as follows:

1. Pretreatment of the metal.
2. Cleaning.
3. Anodizing.
4. Dyeing.

Highly polished metal will produce a glossy and lustrous anodized surface with high light reflectivity while metal with a rough surface will produce a correspondingly rough or flat coating. Bright or polished surfaces may be produced by ordinary buffing, or for very irregularly shaped objects, electrolytic polishing may be practical. Flat or non-reflecting surfaces are obtained by sand-blasting, etching or with alkaline or nitric acid etchants. Hot caustic soda solutions etch in a few seconds to produce coarse-grained surfaces that are attractive in certain applications. Hot soda ash solutions require more time, are easier to control, and produce a finer grained surface. Dilute nitric acid leaves the metal with a fine grained

surface. The finest grained surface results from stripping a thin anodic coating. A finish simulating wood might be obtained by rolling the aluminum sheet between rolls engraved to imitate the grain markings of wood, anodizing in chromic acid and dyeing. Other decorative designs may be produced by engraving, etching or sandblasting before anodizing.

Foreign matter may be removed from the metal surface in the customary manner. In some cases vapor degreasing is satisfactory. Occasionally, vapor degreasing followed by alkaline cleaning may be necessary. Some silicon bearing alloys give better results if etched for a few seconds in a $HF\text{-}HNO_3$ mixture (1-8) and rinsed before anodizing. After cleaning, the work must be thoroughly rinsed before anodizing. It is important that the work is not touched after cleaning until the entire anodizing and dyeing operation is completed.

The same principles of racking followed in anodizing for aircraft construction are applicable to color work. Good contacts are necessary. Unnecessary shielding should be avoided because lack of uniformity in coating thickness is revealed in color work. Internal contacts are recommended, where the work permits their use.

Other things being equal, the intensity or depth of color produced is proportional to the thickness of the anodic coating. As a result, anodic coatings that offer sufficient corrosion resistance and provide a satisfactory paint base may not produce the desired depth of color.

Lower pH, Faster Time

Factors affecting the thickness of anodic coatings are: pH of the bath; voltage; temperature; time. The voltage is not critical. For most purposes alloys 2S, 24ST, 17ST are anodized for 1 hr. at 40 volts and 125 deg. F. in a chromic acid solution of pH 0.8 to 1.0. Lowering the pH will give thicker films and permit a reduction in anodizing time and temperature. No. 17ST has a tendency to be dusty after dyeing. The result may be improved by anodizing at a lower temperature for a longer time. Alloys 3S and 52S are anodized 1.5 hr. at 40 volts and 125 deg. F.; 218 (8 per cent Mg) for 1 hr. at 40 volts and 110 deg. F.

Because of the anodizing characteristics of silicon-aluminum alloys it is advantageous to anodize for a shorter time at lower voltage and temperature. Alloys No. 13, 85 and 195, for example, are anodized for 30 min. at 30 volts and 95 deg. F. No. 356-P6 gives satisfactory results when anodized 1 hr. at 40 volts and 95 deg. F. Increasing the anodizing voltage, time or temperature beyond the value given results in thinner films and work that is generally less satisfactory.

After anodizing, the work should be rinsed well in cold or tepid water. Care should be taken not to touch the work after cleaning and anodizing for fingerprints are developed and made visible by the dyeing operation.

The dye-tank should be of stainless steel, glass or cypress wood. For black dyes an ordinary iron tank may be satisfactory. It should contain steam coils with automatic controls so that the temperature may be maintained at a constant value. Gentle agitation is beneficial.

The dye is dissolved in ordinary tap-water; if necessary, the pH can be reduced with acetic acid.

The use for which the finished work is intended is an important factor in selecting the proper dye. If the finished work will not be exposed to direct sunlight and will not be subjected to repeated washing, the fastness of the dye is not important and attention can be given to the ease of application. If the work will be exposed to direct sunlight the light fastness of the dye is of primary importance.

All dyes are not applicable to this process.

Factors which may affect the depth of color, shade or hue are: Concentration of dye solution, pH temperature and time of immersion. The conditions for the successful application of mixed dyes are usually critical, for the dyes making up the mixture may not have the same rate of absorption under a given set of conditions. Unevenness of coloring may be reduced in some cases by adding sugar or by lowering the pH of the dye bath by the addition of acetic acid.

Over-anodizing may cause the surface to be covered with a "dust" or smudge. Bronzing of the color may be caused by high dye concentration or high dye bath temperature.

Boiling in water sets or fixes the color and increases the fastness to washing of some dyes but generally changes the shade and hue. In those cases where extreme water fastness is desired the dyed work is immersed for 10 to 20 min. in a solution of nickel acetate with a pH about 5 at a temperature of 200 deg. to 210 deg. F. The pH is adjusted by the addition of a small amount of acetic acid. After fixing the color the work is washed in hot water and dried.

No Fast Color Guarantee

All dyes are more or less fugitive to light. As might be expected, fading is more noticeable in the light shades. It is more difficult to obtain light fast greens and reds than it is blues, yellows and blacks.

The life of dyed anodic coatings can be extended by the use of protective coatings such as wax and clear lacquer.

The author presented some experimental data on dyed anodic coatings, and tests for mechanical, water and light fastness, of yellows, greens, blues, blacks and reds.

Water fastness was tested by boiling for 60 min. Mechanical fastness, or dusting, was noted by rubbing with a soft white tissue. Light fastness was determined by the light method. All data were obtained with polished panels of alloy 2S (commercially pure Al) anodized at 125 deg. F. for 60 min. at 40 volts in a bath containing 100 to 110 grams per liter total CrO_3 and little or no trivalent chromium. The pH of the chromic acid bath was found to be a minor factor.

The following dyes were found to be generally good: Solatine Yellow FF Concentrate; Wool Yellow Extra; Quinoline Yellow P; Aluminum Yellow A; a mixed green (one part Pontamine Fast Turquoise 8 GL concentrate 150 per cent, two parts Quinoline Yellow P Extra); Olive Drab; (Aluminum Blue 3B one part, Aluminum Yellow 2A one part, Anthracene Chromate Brown EBA EX Concentrate 2 parts); Pontamine Fast Turquoise Blue 8 GL; Aluminum Blue A; Niagara Sky Blue 6B; Niagara Direct Blue RW; Nigrosine JB; Guinea Red GL; Azorubine Extra.

Techniques for Plating Indium

A TALK on indium was given by William S. Murray, Indium Corp. of America, describing the progress made in the past two years. The speaker traced its history and described its physical and chemical properties.

The use of indium has extended today into many fields, as an electrodeposited and diffused surface on various nonferrous metals. Although the method of application is electrodeposition, the result of diffusion is amalgamation, whereby a surface alloy is formed which is corrosion resistant, non-porous and of increased hardness. With metals such as copper, gold and silver, the surface alloy is capable of

(CONTINUED ON PAGE 134)

Prefill Injection System For Die Castings

. . . Now that die casting machines of the prefill injection type have been in operation for periods ranging from 3 to 12 months, it is becoming increasingly evident that die casting practice generally will be affected by the new method. Virtual elimination of porosity results in greater strength and utility to non-ferrous castings of a size heretofore considered beyond the range of commercial die castings. Practice at the National Cash Register Co. is described herein.

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By FRED C. ZIESENHEIM, M.E.
Lester-Phoenix, Inc., Cleveland

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THE scope of die casting is being broadened by prefill injection because this method makes possible the production in sound die castings of larger, heavier parts from aluminum, magnesium and copper alloys that in the past have been made by sand or permanent mold casting and have been regarded as unsuitable for successful die casting.

For example, the National Cash Register Co., Dayton, Ohio, has recently begun the production of aircraft carburetor parts on a Lester-Phoenix cold chamber die casting machine equipped with a prefill injection system, Figs. 1, 2 and 3. While these parts, Fig. 4, are not large, they are of heavy design, having wall thicknesses ranging from ¼ to ⅜ in., and are required to meet such high standards of strength and density that it had not been possible to make them satisfactorily on other die casting equipment. Like many other wartime products made by National Cash Register, they were originally designed for sand casting, but their high-speed production by the die casting process has been far more satisfactory and has led the foundry officials of the company to believe that further conversions from sand casting may be made successfully not only in the case of war products, but also in the postwar production of cash register parts.

Before describing this particular job further, however, it would be well to explain the nature and operation of the prefill injection system. To do this, it is necessary to note the causes of porosity in die castings, and to review briefly some of the methods employed to combat it. For simplicity's sake, the discussion will be confined to the casting of high melting point alloys such as aluminum, brass and magnesium.

Porosity is caused by (1) entrapped air and gases and (2) shrinkage voids. Since the inception of modern die casting practice it has been known as a generality that porosity is reduced as injection pressure increases, but successful methods and equipment for creating, applying and holding

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FIG. 1—Prefill equipped Lester-Phoenix HHP-3X die casting machine in action at National Cash Register Co. plant, Dayton, Ohio. Vertical oil reservoir for prefill system is visible at far right end of machine. Note massive frame and die locking mechanism necessary to withstand the high pressure from prefill injection cylinder.

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high injection pressure on the metal as it chills in the die were not developed until recently.

In the past, considerable emphasis has been placed upon the necessity of high injection velocity for cold chamber die casting of high melting point alloys. This was evidently a hangover from the days when air gooseneck injection was used for these alloys and when injection pressure depended primarily upon the speed with which the metal was introduced into the die.

Accumulator System Compared

To increase injection speeds, the air or nitrogen filled pneumatic-hydraulic accumulator bottle was brought into use. It increased injection speeds, but over a period of time absorption and leakage of the gases used would cause its pressure to decrease, so that castings produced were not uniform. Besides, most of the hydraulic capacity of the accumulator was dissipated in making the shot, leaving little energy for applying pressure to the casting at the end of the stroke. It is therefore obvious that high speed injection by means of an accumulator was not the real answer to the demand for greater density in castings, for metal thus squirted at high velocity against the die walls tends to close and seal the air vents, thereby entrapping the air and gases and creating porosity. (The accumulator bottle also brought a serious safety hazard to die casting—the danger of explosions resulting from the use of compressed air together with oil, or in instances where nitrogen was used, from the careless introduction of oxygen into the bottle instead of nitrogen.)

It remained for permanent mold casting, a competitive process, to point the way to better die casting procedure. In this process, molten metal is poured by gravity into heated metal dies and flows slowly from the bottom upward, thereby allowing air and gases to escape ahead of the molten metal. Aluminum castings so made were superior to those made at high injection velocity on pressure die casting machines. It became evident that if the virtue of slow movement of metal could be combined with high final pressure on the metal as it chills, plus the rapid cycling of the die casting process, a great forward step would be made.

The prefill injection system is the outcome of this reasoning. It is now apparent that porosity can be eliminated by (1) slow injection velocity, as slow as chilling of metal and thickness of casting section will permit; and (2) high final injection pressure on the metal as it chills in the die.

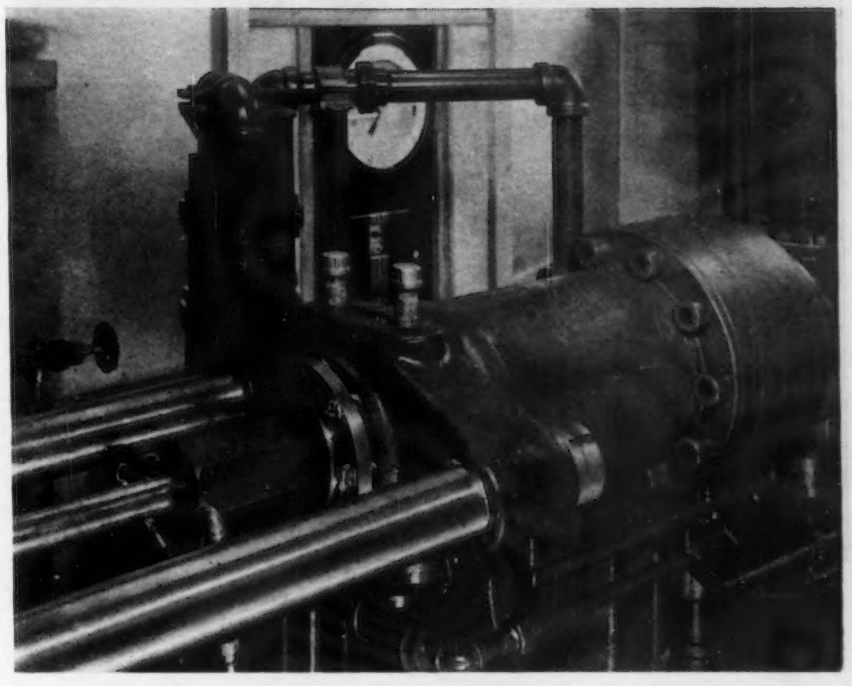


FIG. 2—Close-up of prefill cylinder.

Prefill System Described

The system (see Fig. 3) consists of a hydraulic cylinder fitted with a large actuating piston, the hollow piston rod of which contains a passageway to a smaller inner fixed piston. Oil under 1000 lb. per sq. in. hydraulic pressure is introduced through the hollow piston rod, displacing at high velocity the cylinder opposing it, which is in-

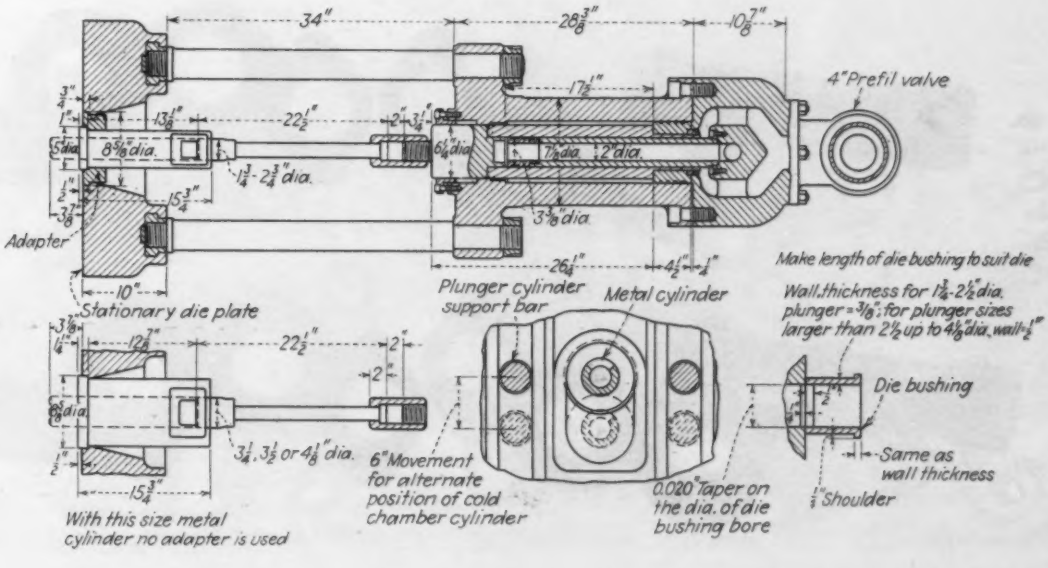

34"
28 3/8"
10 7/8"
4" Prefil valve
17 1/2"
22 1/2"
13 1/8"
8 5/8" dia.
1 3/4 - 2 3/8" dia.
6 1/4" dia.
7/8 dia.
2" dia.
3 5/8" dia.
15 3/4"
Adapter
10"
Stationary die plate
26 1/4"
4 1/2"
Plunger cylinder support bar
Metal cylinder
Make length of die bushing to suit die
Wall thickness for 1 3/4-2 1/2" dia. plunger = 3/8"; for plunger sizes larger than 2 1/2 up to 4 1/8" dia. wall = 1/2"
Die bushing
Same as wall thickness
1/2" Shoulder
12 7/8"
3 1/4, 3 1/2 or 4 1/8" dia.
6" Movement for alternate position of cold chamber cylinder
0.020" Taper on the dia. of die bushing bore
With this size metal cylinder no adapter is used

FIG. 3—Drawing of prefill cylinder assembly, showing the small fixed piston and combination cylinder - piston it drives during the prefill portion of the stroke.

FIG. 4—Five aircraft carburetor parts made on Lester prefill machine at National Cash Register. Note heavy gates, smooth lustrous surfaces of castings, and clean edges, relatively free of flash.

tegral with the main or large piston. As the latter moves forward at high speed, oil flows by gravity from a vertical storage tank, or stand pipe, through the prefill check valve to occupy the space back of the large piston head. When the die cavities have been filled, 2000 lb. oil pressure from a booster pump is applied directly to both pistons, resulting in high sustained final injection pressure which packs the metal into the die as it chills, offsetting shrinkage and reducing in volume any entrapped air or gases present in the casting. When the injection piston reverses, the oil is returned to the gravity tank and oil sump, ready for the next cycle.

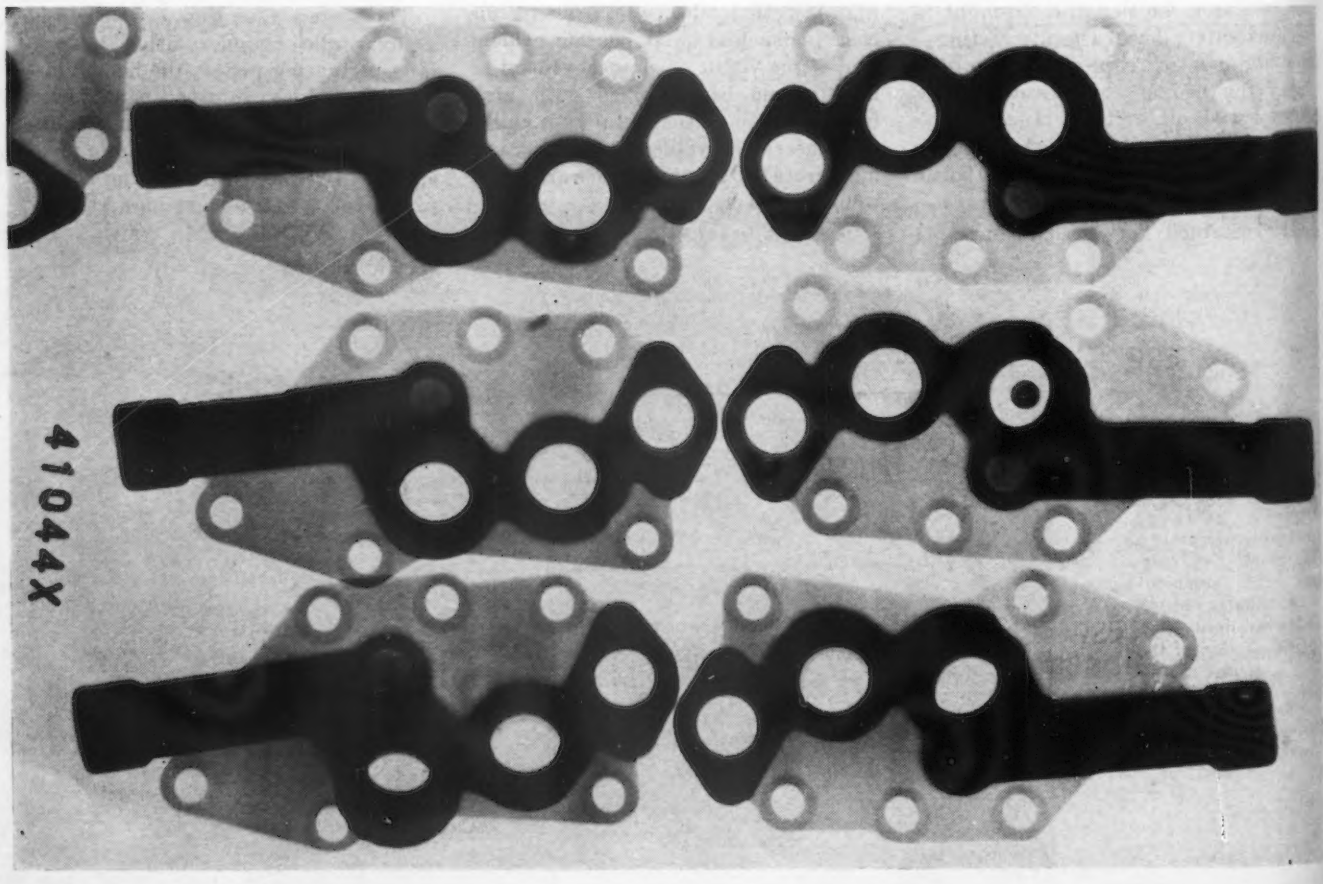
The hydraulic principle of this device is not new, but its application as an injection system for pressure die casting is new. It has been used on fast traverse hydraulic presses wherein the initial movement is rapid, then is reduced as high pressure is applied.

The term "prefill" is properly used to describe the pre-filling of the injection cylinder with oil before the final hydraulic pressure is applied, but it also may be taken to mean the pre-filling of the die cavity with metal before the final pressure of the injection plunger is applied.

Advantages Cited

The advantages of the prefill injection system are best explained as follows: Relatively little pressure is needed to introduce a shot of molten metal into a die cavity, because up to the point where the metal enters the die, minimum resistance is opposed to it. Thus the small hydraulic piston, under relatively low pressure, performs this operation, pulling the large piston along. Then the large piston, with the volume behind it already filled with oil, can apply its entire potential energy and pressure to the

FIG. 5—X-ray photograph showing group of perfect carburetor castings. All of these parts must pass both air pressure and X-ray inspection.



metal in the die. The contrary is true in the case of accumulator injection, where the pressure is largely exhausted at the end of the stroke, and there is little energy left to apply pressure on the metal in the die.

As indicated in Fig. 3, the large piston in the Lester HHP-3X-S prefill injection system has a diameter of 7⅛ in., which in the production of 3-lb. aluminum castings affords an injection pressure of 33,000 lb. per sq. in., applied through a 1¾-in. plunger. Pressure applied to the inner part of the piston through the fixed piston rod cancels out the effect of that rod in blanking part of the main piston area. The injection system is powered by a compact, self-contained, direct motor driven hydraulic system whose capacity is 88 gal. of oil per min., powered by a 25-hp. motor driving three pumps. On the other hand, if a 7⅛-in. hydraulic piston was used directly to inject and pack the metal under such pressure, without the prefilling of the die cavities, an oil capacity of 400 gal. per min. would be required to supply the hydraulic capacity needed. Such pumps and power units would be far out of proportion for the die casting process.

Although it has been pointed out that the best castings are made with low injection speeds, this is a matter of relativity, and it may be desirable to increase or decrease the speed of injection according to the weight and section thickness of the casting and according to the die being used. The prefill system is arranged to enable the die caster to vary the movement of the small or injection piston to any speed he desires, while the final injection pressure remains high and constant.

The injection velocity and pressure applied by the prefill injection system can be constantly uniform, since they result from a solid column of oil under sustained pump pressure and are not dependent upon expanding gases. The pressure and hydraulic capacity of an accumulator system depend upon the pressure at which the bottle is charged with air or nitrogen, which pressure diminishes in service by leakage and absorption until a recharge of nitrogen or air is made. The prefill system is operated at lower cost than an accumulator because no recharging is necessary.

It is possible, of course, to use the prefill system in conjunction with an accumulator bottle, if conditions require a very high injection velocity. In making die castings of magesium, which chills very rapidly, this combination may be used. Such a combination would result in the highest possible injection velocity and the maximum final injection pressure, since the accumulator would be used for high injection speed only, and not for final injection pressure. However, in most cases, it is recommended that injection speeds be kept at the lowest possible rate for the reasons detailed above.

Effect on Die Life

Another important factor is that of die life. The thermal shock to the surface of the die cavities from the impact of molten metal at high velocity is so great that, even if the die cavities were made of rubber, they could not expand and contract as rapidly as is required of them. The effort of the surface to expand and pull the balance of the die steel with it, results in deterioration and ultimate destruction of the die surface. Slow injection velocity does not transmit so drastic a thermal shock, so die temperatures may be half those resulting from high injection velocity, and ultimate die life may be doubled. Erosion and frictional heat of high velocity metal adds to die temperature and reduces die life, as compared with slow injection velocities.

By this "slow squeeze" injection method, as it has sometimes been described, aluminum, brass and magnesium die castings can now be produced with such strength and density that they are suitable for critical stress loaded applications where die castings were not heretofore accepted.

As this is written, the National Cash Register Co. is die casting about 12 carburetor parts similar to those shown in Fig. 2, making them of aluminum-silicon-copper alloys. All have unusually heavy gates, to enable the tremendous pressure of prefill injection to take full effect and to produce castings able to pass X-ray and air pressure inspection. There would be no point in using the pressures induced by the prefill system on a die made with thin, narrow gates which would not allow the pressure to take effect. This is a point of die design which should be considered by all die casters seeking greater density through higher injection pressure.

Dwell Provided

Another factor involved in producing castings like these, is the dwell time within the die. Most of these parts remain in the die for the final application of high pressure for 8 sec. after the shot. As a result, production may be relatively low, being in this case, approximately 90 shots per hr. for most of the parts shown.

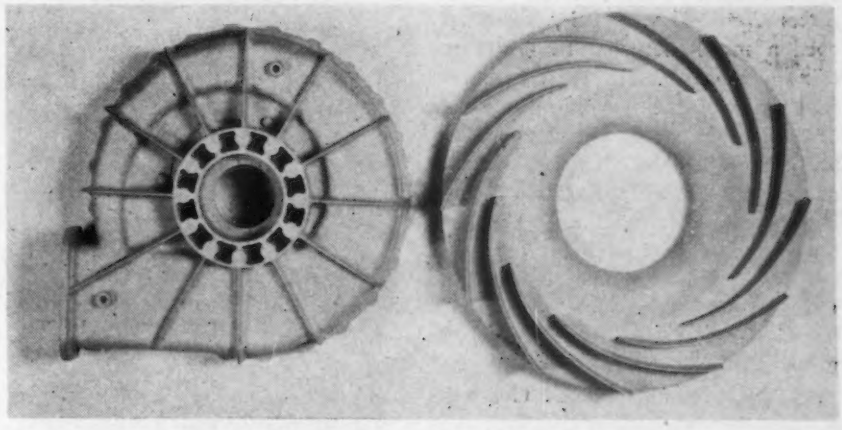


FIG. 6—Aircraft parts (not made by National Cash Register) made of aluminum-silicon alloys. They are 16 in. in dia. and weigh 9½ and 12 lb. respectively.

On this job, however, speed of production is not nearly so important as quality of castings. That the desired quality as achieved is indicated by the fact that despite the severest inspection standards, rejects average less than 2 to 4 per cent of production. This is remarkable because the thick wall sections render internal shrinkage much more likely to occur than in lighter castings.

Since it is impossible for them to make castings like these on any but their prefill equipped Lester machine, National Cash Register has as yet no basis of comparison as to rates, costs, production or rejections on these castings. Perhaps some indication of the value of the equipment to the company may be obtained from the die designer's statement that he "would not dare to design dies for parts like these for any other machine."

In this connection it should be noted that the pressures generated by

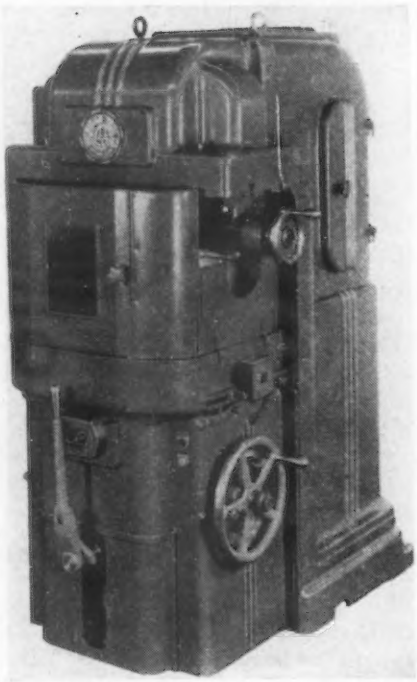
(CONTINUED ON PAGE 130)

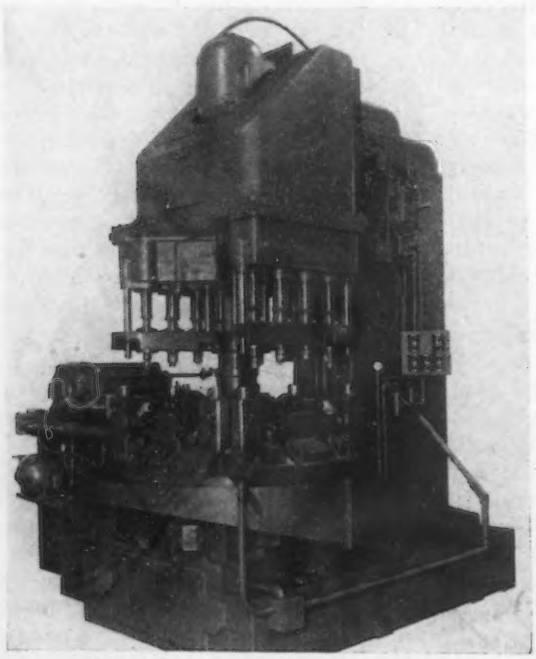
New Equipment . . .

Machine Tools

. . . Recent developments in boring, grinding and lapping, gear finishing and thread milling machines and a number of special purpose production units are described in the following pages.

FOR handling core drilling, boring and counterboring operations in track links for heavy duty tractors, *Baker Bros., Inc., Toledo,* has developed a multi-operation two-unit machine of the automatic cycle type. At each cycle of the machine two track links are produced, one right hand and one left hand. The machine is arranged with a four-station power index table, allowing for loading and unloading of two parts at chucking position while machine is cutting. The vertical extra heavy duty 60-HO Baker hydraulic feed machine performs the various operations in the two large bores in the links. This unit is furnished with a heavy duty 12-spindle, large size head. The large size feeding cylinder with ample feed pressure for the operations is mounted fixed on the center of the index table; the index table carrying work holding fixtures rotates around this





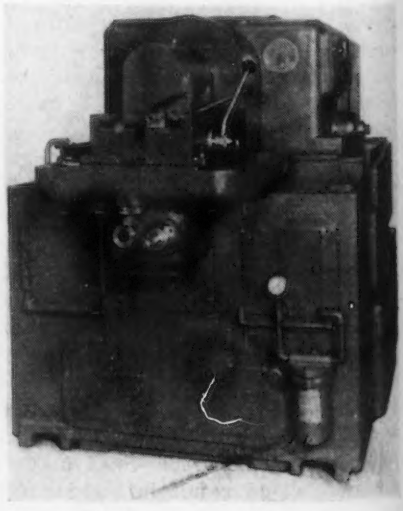
cylinder. The horizontal unit with multiple head drills the two bolt holes in the side of links.

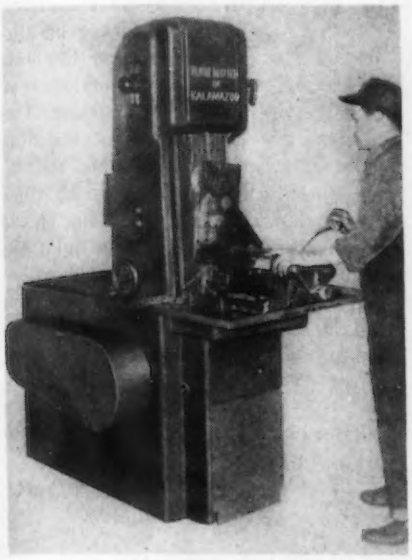
Rotary Gear Finishers

A SERIES of rotary crossed-axis gear finishing machines is currently in production at *Michigan Tool Co.,* 7171 E. McNichols Road, Detroit 12. The line comprises four basic models —the 860 for shaving narrow face and shoulder gears by the underpass method, the 860-B for shaving wider faced gears by the transverse shaving method, the 860-A in which both the underpass and transverse shaving methods are provided, and the 860-C for shaving of internal gears. The first three models mentioned come in three sizes, for shaving gears with a maximum o.d. respectively of 8, 12 and 18 in. Among improvements claimed in the machines are the use of Cone-Drive gearing having a comparatively higher load capacity, provision of increased power to form a reserve for special jobs, improved facilities for curve-shaving, greater flexibility in application of the same machine to different jobs, and reduced maintenance through a one-shot automatic lubricating system.

Gear Shaving Machine

A MACHINE for shaving internal spur and helical gears has been recently placed on the market by the *Fellows Gear Shaper Co.,* Springfield, Vt. This machine operates on the parallel axes method, in that the shaving tool and work are held with their axes parallel to each other when the tool is operating. A rotary type of shaving tool is employed. This is held on a rigidly mounted spindle which is reciprocated at comparatively high speed. The work is held in a fixture mounted on an adjustable knee, which is operated by a depth feed cam for bringing the work into contact with the tool under pressure. The desired shaving action is obtained by proportioning the rotation of the tool and its reciprocation so that the tool "skids" on the tooth profile of the work, thus effecting the desired shearing action. Maximum capacities are: diametral pitch 6 in., face width up to 1½ in. for 10 pitch and 1 in. for 12 to 16 pitch.





Abrasive Belt Grinder

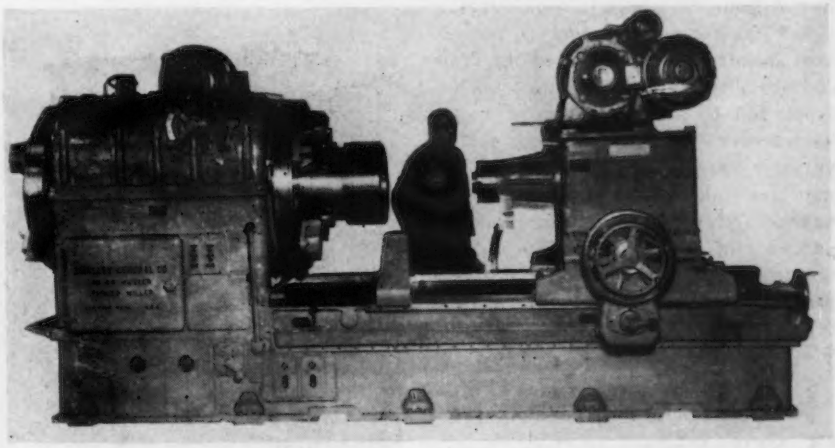
A 10 in. abrasive belt grinder has just been announced by *Hammond Machinery Builders, Inc.*, 1612 Douglas Ave., Kalamazoo 54, Mich. This new wet-n-dri grinder, Model V-10 carries up to 10 in. abrasive belt. The abrasive belt can operate to the edge of the belt backing-plate where clearance is provided for getting into corners. The machine is now equipped as standard with either of two types of tables, oscillating or plain. The oscillating table has a micrometer stop for accurately controlling depth of grind and has three T-slots for attaching fixtures. It has a single handle for both feeding and oscillating the work. A feature of the machine is the idler pulley mounted on a heavy column which incorporates a built-in automatic belt tensioning device. A coolant tank unit located in the base of the machine provides for wet grinding operations; for dry operation a connection for exhaust is provided.

Angular Way Grinder

MATTISON MACHINE WORKS, Rockford, Ill., has developed a new type grinder for finishing tables, slides, saddle, heads, turrets and other parts, having angular machined ways or surfaces. The Mattison precision vertical-spindle way grinder can also be used for grinding flat parts, where it is not necessary to remove an excess amount of stock. The grinding head unit is mounted on dovetail casting slide, which is part of the vertical slide assembly. This slide is adjustable horizontally by hand or rapid traverse by electric motor drive. The head unit can be swiveled 60 deg. Graduated circle permits rough setting of grinding unit to desired angle. Final adjustment is made by means of sine bar or checking gage. The grinder is built in various sizes with tables ranging 12 in. wide and 48 in. long to 36 in. wide and 192 in. long.

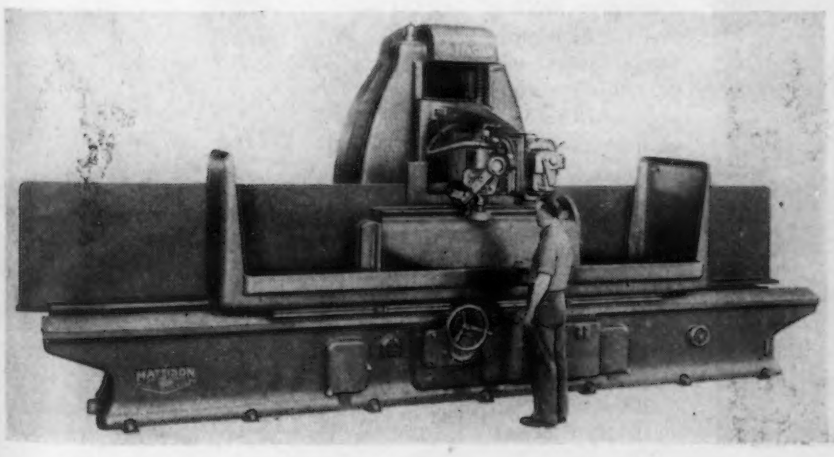
Large Thread Millers

THE *Smalley-General Co.*, Bay City, Mich., has brought out a heavy duty thread miller for large as well as long threads. This machine, its No. 44 MB, will mill 0.8 in. pitch threads (1¼ threads per in.), 18 in. in diameter, 12½ in. long. This can be done by using a multiple ring tooth cutter or a single cutter as desired. It has a nominal swing of 44 in. diameter, and has an 18½ in. hole through the spindle. The illustration shows the machine as equipped for milling gun tubes for 4.7 in. guns, 8 in. howitzers, and 155 mm. guns and howitzers. To mill the breech rings it is only necessary to remove the faceplate from the front end of the main spindle and attach a pot chuck. With a Speed-Trol drive, the work spindle can be rotated at any speed from 4.5 to 120 r.p.m. Cutter speeds 125 times faster than the main spindle can be instantly obtained.



Lapping Machine

A FINISHING machine designed for simultaneous finishing operations on one or several cylindrical surfaces is announced by the *Norton Co.*, Worcester, Mass. The Norton Simplex lapper is adapted to handle the kind of surfaces as are found in radial aircraft machines, having cylindrical sections between shoulders, which do not lend themselves to conventional production lapping methods. The machine can handle concentric and eccentric cylindrical portions at the same time, as well as such sections as the pins of the short-throw cranks of compressors and the journal and eccentric members of small camshafts. Surface finishes as low as 1 micro-in.



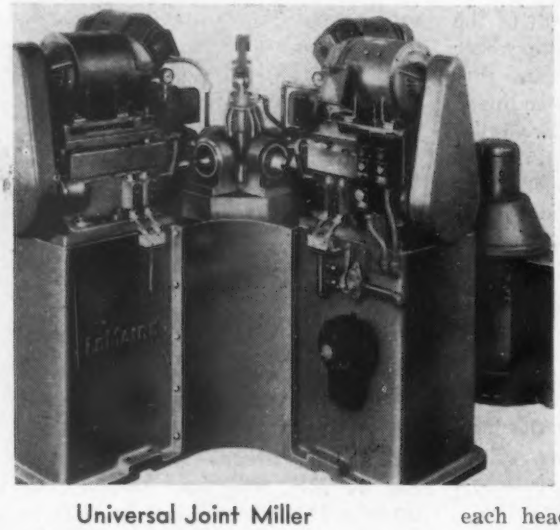
R.M.S. are obtainable in a single quick operation. The lapper has a capacity from ½ to 2 in. on diameters with lengths up to 24 in.

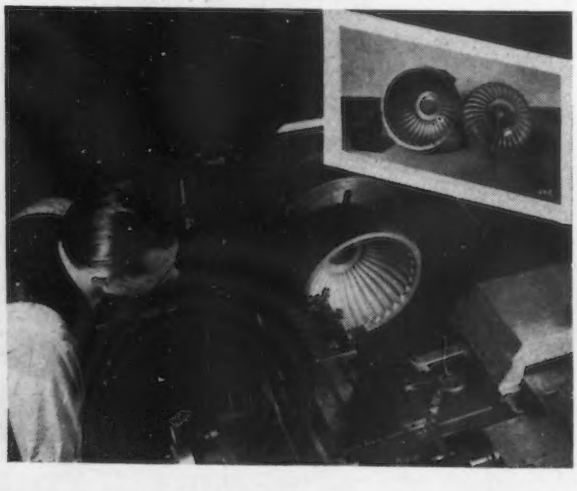
Floor-Stand Grinder

FOR heavy-duty snagging, the *Vonnegut Moulder Corp.*, 1811 Madison Avenue, Indianapolis, is presenting the Marschke Vari-Speed grinder with 24 or 30-in. wheels. Motors are from 25 to 40 hp., with momentary overload capacity of 50 to 80 hp. Automatic regulation of variable speed control assures correct peripheral speed. Belt velocities range from 4000 to 5000 f.p.m. and belts transmit from 160 to 200 per cent of motor horsepower capacities. The motor, variable speed transmission and bearings are under cover to protect them against external contacts and coarser particles of dirt or grit. The spindle is supported in three large roller bearing housings of a self-alining type designed for 20,000 hr. minimum life expectancy.

Shape-Turning Lathe

A NEW shape-turning lathe, which makes possible turning, boring or facing in almost any desired shape and which will handle work up to 16 in. in diameter, is announced by the *Monarch Machine Tool Co.*, Sidney, Ohio. The "Shape Master" mechanism consists of three elements. One controls the shape cut, another regulates the rate of repetition of the shape on any given circumference, and a third controls the contour generated on successive diameters. The tool actuating mechanism, mounted on the carriage crossbridge in place of the usual compound rest, is cam operated. A cam follower is linked to the movable tool carrier and guides the tool in a shaper-like stroke which is adjustable from 0 to 2 in. The master cam itself records only a single element or unit of the desired design or pattern, whether oval, triangle, square, hexagon or a non-geometric shape. In the fluted dish mold illustrated, for example, the master record would represent the curvature only of a single flute. Repetition of the shape to be cut is determined by the geared relationship of cam and spindle revolutions.



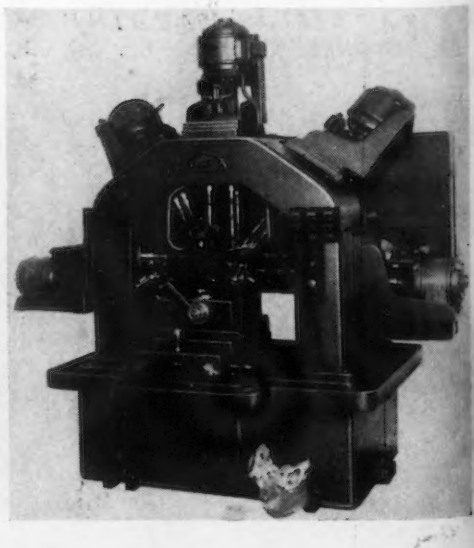


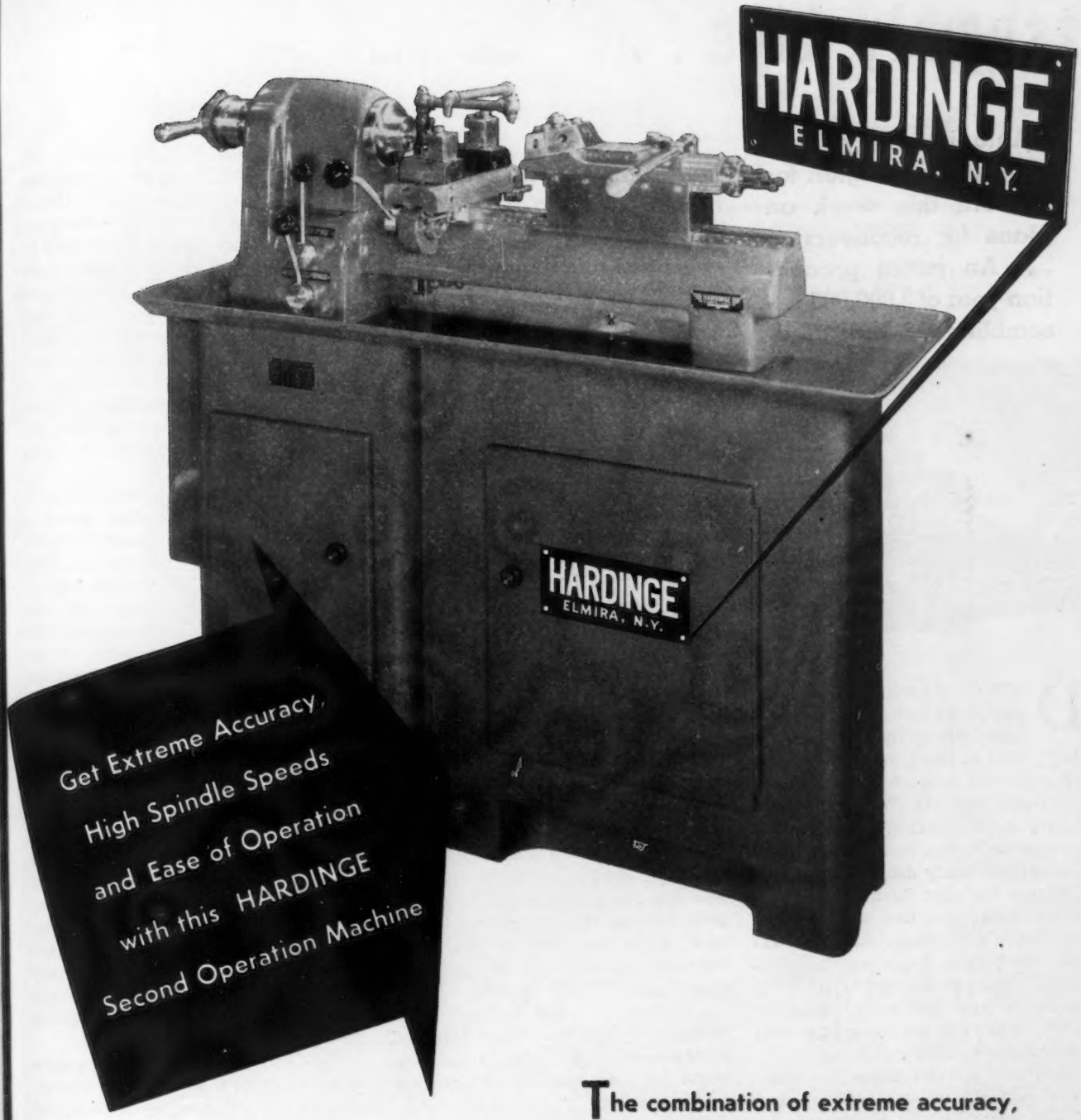
Universal Joint Miller

A FOUR-WAY universal machine has been developed by *LeMaire Tool & Mfg. Co.*, Dearborn, Mich., for hollow milling and facing of universal joint spiders. Four standard end bases each supporting a LeMaire twin ram hydraulic unit are bolted to a special center base. The piece to be machined is merely laid on the center fixture where it is automatically locked and held securely by air clamps while four spindles operating at stations 90 deg. apart machine the outside diameter and face shoulders of the four trunnions of the spider. The spindles are arranged to machine various diameters at various speeds. Each spindle has a sleeve which rides on precision ball bearings. This sleeve is supported in brackets and held stationary while the spindle revolves inside. This eliminates any galling and possible chip trouble. The same type machine can be arranged for boring, drilling, reaming, etc., and in many cases threading operations can be done in same setup. Using an automatic or hand index table in the center, the machine can perform different operations at each spindle.

Tapping Machine

A MULTIPLE direction tapping machine for tapping aircraft cylinder heads has been designed and built by *Snyder Tool and Engineering Co.*, 3400 E. Lafayette Ave., Detroit 7. This special-purpose machine is made with varying numbers of tapping units and various combinations of single and multiple spindle heads, depending upon the requirements of the specific job. The tapping units are adapted for individual lead screw tapping and consist of two parts — the motor mounting bracket and the first reduction gear unit, including limit switches and controls. The head on any tapping unit may carry one, two, three or four lead screw spindles, depending upon requirements. For setup purposes, each head has a push button which operates that single head forward.





CAPACITY:
1/16" to 1" with collets
1" to 6" with step chucks
1" to 5" with jaw chucks
Spindle Speeds:
100 to 4000 r.p.m.

The combination of extreme accuracy, high spindle speeds and ease of operation means better results under the close tolerances of manufacturing standards both today and in the days to come. The ease and simplicity of operation enables relatively unskilled operators to produce parts to the necessary close limits without expensive tooling.

"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

Assembly Line . . .

STANLEY H. BRAMS

• Auto industry looks toward Washington for a word this week on plans for reconversion . . . An initial production year of 3,000,000 assemblies is indicated.

DETROIT—Automobile company executives are awaiting with high interest the sailing orders they expect to come out of the meeting scheduled between their company presidents and the War Production Board, in Washington July 14. The expectation is that reconversion planning will be fairly definitely outlined.

Within the past fortnight all companies have submitted briefs which describe in fair detail their reconversion viewpoints, hopes and requirements. The subject matter of these outlines is split into rather down-to-earth headings, with supplemental information included.

Basically, the companies have indicated to WPB the minimum number of cars they feel they can produce on a break-even or modest profit basis. Along with these practical minimums, they have included, in some cases, the expectancy of production under unlimited conditions.

All companies have set forth their basic requirements of machine tools, plant space and manpower to produce the minimums and the largest possible volume. In some cases these requirements have been further broken down into varieties of machine tools, type of plants, and qualifications of manpower capability.

With this information at hand, WPB has been readily able to put the individual company totals together and see exactly what is required to put the automobile industry back into peacetime operations once more. The minimums make it possible for Washington to say when and how reconversion shall occur for the industry at large.

It might be interposed here that this pattern uses the auto industry as a guinea pig; if it is successful it will be applied to other industries similarly.

Returning to the auto picture, some sources within the industry believe that, as a result of WPB's now-acquired information, a definite date for resumption of passenger car production will come out of this week's meeting. If bets were to be made and the odds were good, some money in Detroit might pick no later than next Jan. 1 as the kickoff date, sooner, of course, if Germany collapses this year. But the bet is hazardous, and the odds would have to be sizable to justify the position.

A better expectation, in most opinions, is that WPB will merely reiterate quite definitely that passenger car output cannot recommence until Germany falls, or until the fall is in sight.

Another result of the tabulation of industry-furnished information for this week's meeting is that WPB will be able to gage rather accurately just how broadly it can permit manufacture of reconversion-required machine tools under priority just below the military requirements. No order authenticating WPB's promise of tooling for reconversion has yet come through; it is believed that this will be released at the July 14 meeting, based on the reports of industry requirements.

These reports also stimulate Washington thinking about what plants will have to be cleared of war contracts, and where their jobs can be transferred if their continued operation is necessary. Problems of manpower would of course run parallel with plant facilities questions, for neither exists today without the other.

THERE is still division of opinion within the industry as to how any authorized production will be divided. But this is not likely to eventuate in the outspoken disagreement which characterized the first meeting in April, when large producers urged that allocations be based on an historical average, and small producers, maintaining they could not survive a uniform percentage reduction, held out for individually adjusted cuts. The reason for probable evaporation of this problem is that it is understood WPB will use the practical minimum figures submitted by each manufacturer as the base points. In actual fact, these can be used without much argument from either camp, because the minimum figure of each concern represents a fairly proportionate reduction from its average totals of the past, with smaller producer figures not far enough away from the average of the industry to start controversy.

As a whole, and as reported here much earlier, the industry seems to have geared itself for about 2,000,000 units as a practical minimum. This would represent between 45 and 50 per cent of total passenger car production during the peak years of 1929 and 1937, respectively, when output measured 4,587,400 and 3,915,899 units respectively.

Actually, the industry would be in considerably better than a 50 per cent position if WPB does its figuring on that basis. It must be remembered that 1945 schedules of trucks call for around a million units, which would be in addition to the passenger car allotments, and the best previous year's U. S. car-and-truck total in history was but 5,358,420 vehicles during 1929. Against 1929, authorized output of 3,000,000 cars and trucks would be nearly 60 per cent, a satisfactory proportion indeed against the all-time record.

The industry will probably recommend, and WPB is likely to concur, that whatever production is permitted be assigned for a period of medium length, rather than split up into fractions which might be produced, say, in three-month periods. An aggregate authorization for one year would permit bunching of manufacturing permitting operations at a profitable level for the period, rather than stretched-out work on a thin break-even basis.

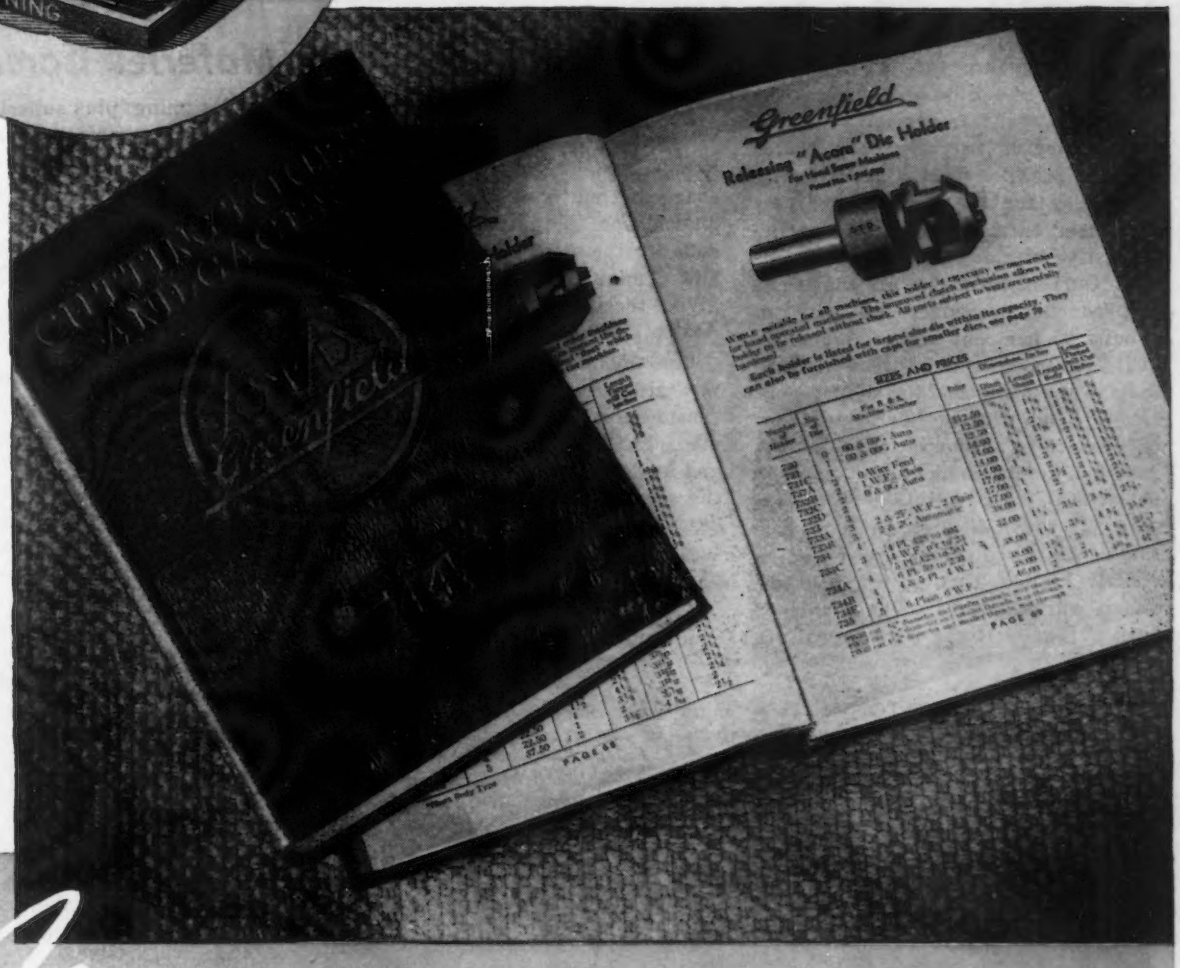
As good as this thesis might be, however, it would likely meet strong opposition from the CIO United Automobile Workers Union, either by formal strike action or by informal, and equally effective, slowdowns. The workers are unlikely to permit volume production when they know the run size is limited.

With 3,000,000 cars and trucks, or approximately that figure

THE LIGHTNING SCREW PLATE &
DIE SCREW PLATE CUTS WIRE
SIZES FROM NO.2 TO NO.18
AND TAPS & DIES MAY BE USED IN
MACHINE OR BIT BRACE IF DESIRED.
HOLDERS FOR THESE PURPOSES BEING
INCLUDED IN THE SET. DIES TAP
WRENCH ADJUSTABLE WITHOUT SPRINGING
AVOIDING ALL DANGER OF BREAKING
LIGHTNING

FROM OUR CATALOG OF 1875

This quaint wood cut was reproduced from the pages of the 1875 catalog of the Wiley & Russell Manufacturing Company, one of the parent companies of the Greenfield Tap & Die Corporation. It shows the "finest threading tools" of that time and the copy modestly states "it is warranted to do five times the work that can be done in the old way."



Now GREENFIELD'S NEWEST CATALOG

Here is a valuable new addition to the library of all who are concerned with the purchase or use of Taps, Dies, Gages, and other small tools. The pages of Greenfield's new Catalog No. 44 include complete and up-to-date listings of sizes and styles, plus a wealth of technical data that will help the engineering and production staffs of every metal-working industry as they work on war and post-war products.

The new catalog has been most carefully indexed and arranged for quick reference. Copies are available from your local "Greenfield" Distributor.

GTD GREENFIELD

GREENFIELD TAP & DIE CORPORATION

GREENFIELD, MASSACHUSETTS, U. S. A.

authorized for production, and with a fair share of the indicated 1,000,000 trucks ear-marked for the military, it is obvious that strict control in selling the new vehicles would be required. This may meet some opposition from Chrysler, whose officials feel strongly that controls should end with the war, but it is likely to be accepted by both General Motors and Ford, the other most dominant industry factors. Chairman Alfred P. Sloan, Jr., of General Motors, and Vice-President Henry Ford II, of Ford, have both expressed viewpoints recently that control measures will be necessary in the immediate post-war period.

Along with necessity certificates or some parallel thereto as rationing machinery for the first run of new passenger cars, there will arise the necessity of clarifying pricing policies. Current estimates are that costs of producing passenger cars will run around 25 per cent higher than their 1941 equivalents, the spread in estimates ranging from 20 to 45 per cent. IF WPB can promise liberal attitudes on price raise authorizations, an OPA function, forthcoming design and experimental work will take a normal turn. If the indication is that price raises will be hard to get and will be strictly limited, then the design emphasis will be toward stripped models.

In any case, if the auto presidents return from Washington this weekend with the promise of 2,000,000 passenger car assemblies for the first production period, they will be definitely satisfied. That will mean, as has been pointed out, an actual 3,000,000 vehicles; and if the initial period is of one-year duration, that will be about all the production which some quarters regard as practical for the starting 12 months. Talk is widespread of 6,000,000 car years, which would mean 7,000,000 vehicle years, but it is generally admitted by more thoughtful officials in the industry that this level of output could not be reached for at least a year after production is resumed.

Authorization for the 3,000,000 quantity, therefore, would provide a properly inclined ramp toward the ultimate higher assembly floor.

Pays Tribute to AAF Materiel Command

Wright Field, Ohio

• • • **Recently**, Maj. Gen. Oliver P. Echols, assistant chief of Air Staff in charge of materiel, maintenance and distribution, paid tribute to the job done by the AAF Materiel Command and America's aircraft industry in giving the U. S. the winning edge over Axis air power.

Gen. Echols starts with the fundamental precept that there is not considerable difference in fighting men, given proper training, morale and leadership. Victory, he contends, therefore comes to the nation with the best and most equipment, which he says is "the ultimate key to military power—both ground and air."

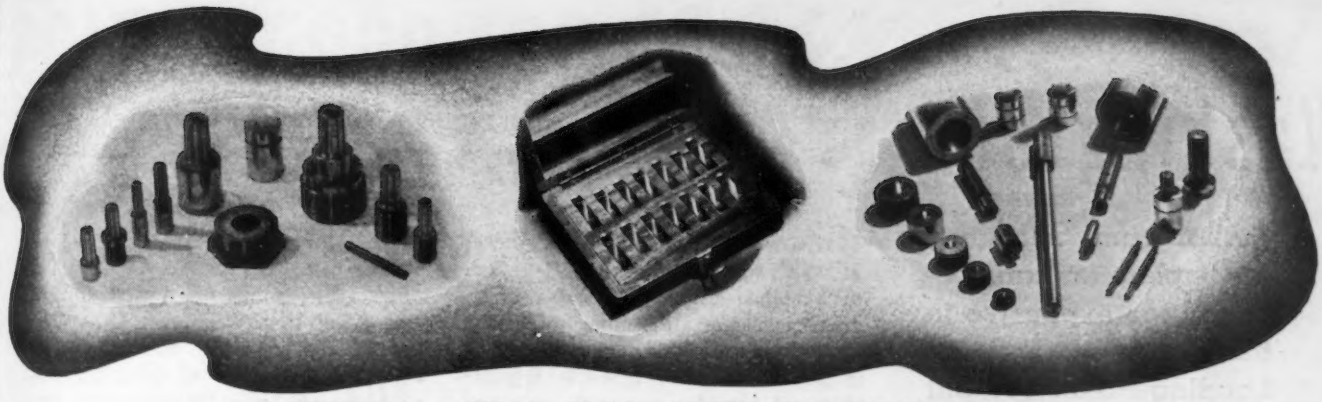
"American airpower ultimately comes down to superior engineering and designing, plus superior manufacturing—the combined result being aircraft, guns, instruments and all equipment, right down to clothing and oxygen masks, that let our men do a better job, that give them the necessary edge over the enemy," writes Gen. Echols. He adds that "Men, however brave, however well trained, however physically fit, cannot win battles with inferior equipment."

Gen. Echols emphasized the insurance value of continuing research. "Fortunately," he said, "the engineering, designing and development of military aircraft and equipment—the materiel of the Army Air Forces—never stopped after the last war. Through good times and bad, for 26 years, the best brains in the Army Air Forces, supplied with the finest equipment in the world for experiment and research, have forged steadily ahead, though often hampered by inadequate appropriations, kept AAF technical development out in front.

Stationed for many years at Wright Field, and as recently as 1943, himself Commanding General, Materiel Command, Gen. Echols knew whereof he spoke when he said: "Fortunately for America, the officers and civilian technicians assigned to Wright Field and given the job of keeping the United States supreme in the air, have kept our designs, well in advance of current practice. When we entered the war, we did not have the planes, the guns, the instruments, the equipment, in quantities—but we had them on paper. We knew what to buy, how to make it and what it would do. It then became a matter of time—not to design but to build! It takes at least three years to design and perfect a bomber which can then be built at the rate of one per hour!

"The B-17 Flying Fortress and the B-24 Liberator, which dominate the global skies today, were developed before Germany invaded Poland.

WILLOW RUN MILESTONE: *Takeoff of the 5000th B-24 Liberator built at the Ford Willow Run plant brought out notables for the occasion. Left to right are Harry H. Bennett of Ford; Lt. Col. Harley S. Jones, AAF resident representative; Maj. Gen. R. Briggs of British Ordnance; M. L Bricker, superintendent at Willow Run; Henry Ford II, executive vice-president; and Henry Ford, president and founder.*



LINCOLN PARK HAS ALWAYS PRODUCED

GAGES and TOOLS of *Lasting* PRECISION

TRUE value and economy in gage use is measured in wear resistance . . . in the inspection accuracy which is maintained well along in the service life of the gage.

It is natural to think of gage wear resistance in terms of materials. Lincoln Park Carboloy gages are known to offer at least fifty times and Lincoln Park chrome plated gages approximately five times the wear resistance of those made of steel. But in any material, and especially in steel, a high surface finish is of paramount importance in guaranteeing a long, accurate service life.

At Lincoln Park, careful control in grinding and lapping produces gages with extremely high finish. A large department, parts of which are shown at the left and which is operated under ideal working conditions and staffed with highly skilled men and women, is devoted to lapping operations alone. Here Lincoln Park Class XX and X gages are finished with Profilometer readings no greater than 1.5 microinches. Readings no greater than 2.5 microinches are guaranteed on Class Y gages.

From Lincoln Park you get gages . . . and many types of precision tools . . . all of which are manufactured to provide the maximum in *lasting* precision.

ARMY (E) NAVY

LINCOLN PARK INDUSTRIES, INC.

Successor to The Lincoln Park Tool and Gage Company and Carbur, Inc.

1729 FERRIS AVENUE • LINCOLN PARK 25, MICHIGAN

Washington . . . L. W. MOFFETT

• Aluminum substitute for tinplate for cans believed too expensive to hurt plate market . . . Landing craft output one of war's great industrial jobs.

WASHINGTON — Scarcity of tinplate is given as the reason for WPB's announcement concerning the experimental use of aluminum for the manufacture of cans for 11 food and non-food products. For this purpose WPB has made about 7,000,000 lb. of aluminum available during the third quarter. Unlike tinplate there is a surplus of aluminum. With heavy war demands, the government plunged into a vast aluminum expansion program which, when completed, found the country with the enormous annual capacity of 2,000,000,000 lb. Great as they were and are demands for aluminum for military use do not take up the capacity.

Hence new uses for aluminum are being studied just as all forward looking industries are looking for new and increased peacetime uses of their products.

The specified cans to be made experimentally of aluminum ordinarily take large tonnages of tinplate. They are to be used for the packing of baking powder; lard; malted milk powder; tobacco; snuff; tooth powder; cereal, beverages and soluble coffee; cocoa; ointments and salve; tablets; and pretzels, crackers, biscuits and potato chips.

The proposed new use of aluminum was established by Direction 4 to Can Conservation Order M-811. All applications by container manufacturers for allotments for aluminum had to be filed by July 10. Applicants were asked to state the product to be packed in aluminum cans and the quantity of steel used in the third quarter of 1941 for the product to be packed. It was required that CMP-4-B form be attached to the letter asking for an allotment of aluminum. WPB said that production will not be authorized in any case where there is a possibility of interference with war production.

THE experiment naturally is being watched with considerable interest by both aluminum and tinplate manufacturers. The latter, however, apparently are showing no concern that aluminum containers will deprive them of markets, at least under the present technique of aluminum manufacture.

For one thing it is contended that the cost of making aluminum containers will be much greater than the cost of making tinplate containers. In some quarters it is claimed that aluminum container manufacture cost will be approximately three times greater than the cost of making containers of tinplate.

Therefore, it is said that markets in this field served by aluminum will be only temporary. It is likewise claimed that there is as yet no means of extruding and fabricating on a production basis aluminum for making containers. With respect to such containers for food products there is the question of treatment of the metal to prevent spoilage.

Meanwhile the technological development in the manufacture of tinplate has been notable. The result has been an improvement in the quality of tinplate and an expanded use of tin cans to preserve foods. This growth is shown by American Iron and Steel Institute figures. According to the Institute more than 12,000,000,000 tin plated cans for food or beverages were produced in 1939 and 1940, about two-thirds greater than the 1929 production.

Preservation of certain green vegetables and fruits and of a larger proportion of many crops which formerly could not be done satisfactorily now is possible through the use of tinplate of superior ductility and corrosion resistance, due to the cold reduction process. This process gives a superior surface finish and greater resistance to rust than the tinplate made by the hot pack rolling method of some 18 years ago. The steel is not only thinner and more ductile, as pointed out by the Institute, but because of its more uniform thickness it can be formed into cans by high-speed machines with fewer rejections for imperfections.

REMARKABLE production achievements by American mills, foundries, machine shops and shipyards together with their working forces are strikingly seen in the huge output of landing craft which have made possible the successful invasion thrusts of the United States Navy in various parts of the world. Indicative of the tremendous demands made on the steel industry to meet the needs of the Navy are requirements for landing craft alone. The

BULLS-EYE: *A Nazi gunner lies dead amid the ruins of this self-propelled German anti-tank gun somewhere near the Normandy beachhead. The gun was pulverized by a direct hit. Note camouflage around the rear of the vehicle.*

POINTS GOOD FOR *150 More Pieces!*

SUNICUT

Doubles Drill Life . . . Improves Finish . . . Increases Speeds

Round, perfect holes — 300 of them per drill grind — that's the present production rate on a certain drilling operation at this large plant. But the rate wasn't always that high . . . as the following facts of the case show.

Poor finish and short drill life had been common complaints of the operators. On the SAE 4140 steel being machined, 150 pieces were the maximum they could get per drill grind . . . the finish was rough, despite the use of a well-known high grade cutting oil. Finally, they made a change in cutting oil at the suggestion of a Sun Oil Engineer. They switched to clear, transparent, sulphurized SUNICUT.

100% improvement in drill life and much better finish were immediate results of the change. They are now able to drill 300 pieces before drills need regrinding. As an *extra* bonus they find SUNICUT permits *increased* spindle speeds . . . further stepping up their output.

Savings in time and money are direct result of the increased production and longer drill life made possible by SUNICUT in this plant. Similar savings are possible on many other metal-cutting operations in your plant. Why not consult with a Sun Oil Engineer today on selecting the right cutting oil for these operations. Call or write

SUN OIL COMPANY · ***Philadelphia 3, Pa.***

Sponsors of the Sunoco News Voice of the Air — Lowell Thomas

SUN INDUSTRIAL PRODUCTS

HELPING INDUSTRY HELP AMERICA

stepped up $6,000,000,000 program for these units that carry fighting men to bitterly contested beachheads calls for 2,945,300 tons of plates, it was stated at the Navy Department. This is equivalent to almost three-months' plate capacity.

Production of landing craft has more than passed the half-way mark of the previously announced program for 80,000 of all types. Completion of the presently authorized program for landing craft will bring the total to about 100,000 vessels and they are being produced on schedule. As an index to the marked increase in the production of landing craft, June, 1943, produced 56,289 tons, the figure rose to 69,575 tons in November, 1943, and in May, 1944, it shot up to 197,901 tons. Three-and-a-half times the tonnage is now sliding off the ways as compared with a year ago. In one month now as many landing craft are being produced as in a whole quarter previously. Some development types of landing craft are now in preparation beyond those so far constructed and in all there will be 15 major kinds of such craft.

"This job of building landing craft is not finished," said Secretary of the Navy Forrestal, "many more landing craft are still to be built before we have enough to get to Tokyo."

Steel Industry Put to Greater Test by Artillery Ammunition Program

Washington

• • • Already faced with demands that have created a tight situation even greater requirements are being placed on the steel industry by the tremendous quantities of artillery ammunition being used by American invasion forces. This has been made clear by a War Department announcement that the unprecedented quantities of heavy artillery ammunition used by invasion forces in Italy, Normandy and the Southwest Pacific have necessitated an immediate increase of several hundred per cent in the Army ammunition program.

Brig. Gen. R. E. Hardy chief of the Ordnance Department's Ammunition Division, stated that contracts for 155 mm. 8 in. and 240 mm. shells have been placed with 56 concerns whose facilities are being rapidly expanded by the addition of approximately $100,000,000 worth of machine tools, presses and furnaces.

"That WPB has granted the highest priority on equipment and material and WMC has similarly granted a high priority on labor referrals sufficient labor must be secured to operate the equipment being installed at its highest rate of capacity in order to meet the demands of troops," General Hardy declared.

Practically all ordnance ammunition loading plants will be expanded to permit increased rates. A similar expansion is taking place in chemical and explosive works.

The Large quantities of ammunition being used by the armed services are indicated by the War Department's statement that Lieut. Gen. Mark Clark's fifth army used 64,750,000 lb. of heavy artillery ammunition during one month of battle to crack the Cassino line and move forward in the direction of Rome. This figure applies only to the Italian front in May and only to heavy guns, that is, 155 mm. and above.

Hazards To Be Corrected In Forge and Foundry Shops

Washington

• • • As part of the national program to spur output of urgently needed castings and forgings, 187 forge shops and foundries were inspected recently and more than 700 orders or recommendations were issued for the correction of hazards to the health and safety of the workers. In making this announcement John M. Fewkes, chief of the WPB Industrial Health and Safety Section, said that inspections are being conducted by the Division of Labor Standards, Department of Labor, and other agencies in cooperation with WPB.

"These inspections," he stated, "are materially reducing absenteeism and labor turnover. They also are making it easier on the management of this critical industry to recruit and retain an adequate labor supply."

Mr. Fewkes reported that regional and district representatives of the Office of Labor Production are maintaining close contact with state departments of labor and health in carrying out the WPB's nation-wide program to reduce occupational diseases and accidents that are hampering production in foundries, forge shops and other critical war plants.

He praised the Illinois and Indiana State Departments of Labor for a "particularly fine job" in aiding the foundry and forge shop program.

THE BULL OF THE WOODS — BY J. R. WILLIAMS

I'LL HAVE TO PUT YOU ON ANOTHER MACHINE FOR A WHILE
SHE LEAVES TH' MACHINE FER A FEW MINUTES AN' WHEN SHE GITS BACK HAFF OF IT IS GONE TO TH' REPAIR DEPARTMENT.
ANYBODY WHO THINKS BECAUSE A PERSON HAS WORKED IN A MACHINE SHOP THESE DAYS HE SHOULD BE ABLE TO KEEP TH' FAMILY MACHINERY IN REPAIR IS CRAZY! TH' CHECK-UP CREWS, JIG SETTERS AN' MAINTENANCE CREWS HARDLY GIVE YOU A CHANCE TO TURN TH' HANDLES ON A MACHINE!
J.R.WILLIAMS
THE VISITING COMMITTEES
T. M. REG. U. S. PAT. OFF.
COPR. 1944 BY NEA SERVICE, INC.

who dares to talk to them about a THIRD WORLD WAR?

They were at Tarawa.
Many of them now wear empty sleeves, or bandages where their eyes were. And a thousand and twenty-six will rise up never from the sands of Tarawa Island.

They couldn't hear it. In the roar of that tornado, as they fought and fell, so far from the hills of home, they couldn't hear the words: "*. . . history repeats . . . and what will we get out of it but . . . how the hell can we police . . . the next one will be against . . . already sowing the seeds for . . . and twenty years from now, brother . . . the Third World War . . .*"
In elevators, on the street, in plush chairs that let you down easy, in columns and editorials and from the political stump.

What is the matter with us? Can't we at home at least go into peace with some spark of their courage and determination that this war is not another mockery, not just another World War? Let no man give voice to that weak and deadly cynicism. Let him stand up and think straight and have the courage to call the lie to any man in public or private life who fails to do the same.

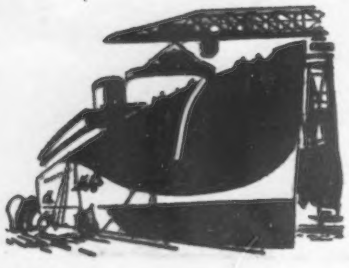
And let each of us do everything humanly possible to help win this war sooner . . . buy War Bonds—give blood—boycott the black market . . . and plan ahead now for a *better* America than we had before.

Today, the engineers of the machine tool industry can greatly help the post-war planners of government and business management. One of these is a Bryant man . . . We invite you to send for him.

BRYANT CHUCKING GRINDER COMPANY SPRINGFIELD, VERMONT, U. S. A

WEST COAST . . . OSGOOD MURDOCK

• Restless, unbalanced manpower and conflicting urgency claims continue to harass management and labor leaders alike . . . Repeated assurance projects present shipbuilding operating rate through 1945.



SEATTLE—One major shipyard with Maritime contracts in the Pacific Northwest is authoritatively said to be 20 days behind schedule due entirely to manpower shortage.

The Portland area, practically entirely devoted to shipbuilding, wants 16,000 more workers, including 4500 replacements, to complete work and contracts for the Maritime Commission. It is anticipated that practically all these persons must come from outside of Oregon and Washington.

Of the 30,394 additional workers reported required in Los Angeles County, Cal., and jointly sought by military leaders, government officials and labor and management representatives, 22,894 are for high urgency war factories including 6331 for shipbuilding.

Rear Admiral Emery S. Land, chairman of the U. S. Maritime Commission and thoroughly familiar with military plans in the Pacific, within the last few weeks publicly declared "emphatically that the work load in the shipyards is to be increased very shortly. . . . Our current construction program and its projection into 1945 is based upon firm recommendations of the joint chiefs of staff."

Rear Admiral Howard L. Vickery, Maritime vice-chairman, personally visited West Coast yards last month to assure management and workers that they should count on continuous employment and contracts through 1945, according to present prospects, and that demands and schedules in the immediate future will be more imminent than at present.

In addition to all existing private and Navy yards on the West Coast, each still crowded to capacity, a new $1,000,000 ship repair plant has been organized at Stockton, Cal., on fresh water with government encouragement and Navy approval, despite local labor and material shortages.

Firm demand for cargo vessels, tankers, naval auxiliaries, escort craft and troop carriers, not to mention fighting ships, continues unabated, and the backlog and prospect of major repair loads is increased from month to month, even though current repair operations are not as heavy as had been anticipated.

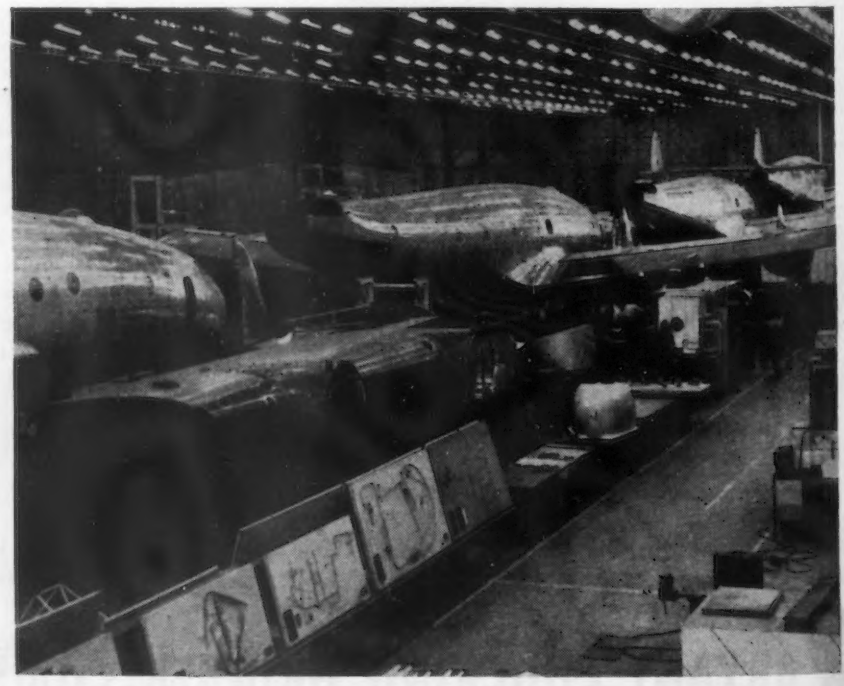
Yet workers are restive, turnover and absenteeism seem impossible to check and high wages and overtime are no longer sufficient incentive to maintain working forces.

IF manpower is short and workers indifferent, jaded and fagged in the ultra-ultra economic atmosphere of shipbuilding, with its highest wages, preferred housing and metropolitan location, it is only natural that the pinch continues even tighter where wages are less and living and working conditions inferior and more remote. That huge Army munitions mystery operation at Hanford in central Washington is a dry sponge that seems never satisfied with its manpower absorption. An appeal has now gone out throughout the Pacific Northwest asking all electrical workers to take a leave of absence for 90 days to work at the project. Private employers are urged to maintain seniority and hold the job for the worker on return. Under present conditions more hearty cooperation might be achieved by a firm guarantee that every worker would be returned intact in 90 days.

At Boeing 1200 high school and young college students have been hired for summer work. Vacations for regular factory production workers and supervisors have been suspended to gain over 1,000,000 manhours for crucial B-29 super-bomber production. In lieu of the time off the company will pay double.

Boeing continues heavy output of B-17 Fortresses as the changeover to all-out B-29 production is made. Additional manhours are required to make the changeover and maintain

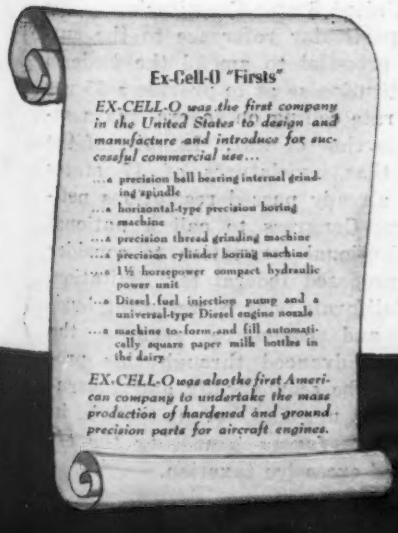
SUPER TRANSPORTS: *New C-69 Constellation super transports pass along the production line at the main Lockheed factory at Burbank, Cal. TWA recently flew one of these planes from Burbank to Washington in 6 hr. 58 min.*



From 1919 to 1944 – a QUARTER CENTURY of ENGINEERING and PRODUCTION ACHIEVEMENT

Solving difficult production problems for American industry has been the business of Ex-Cell-O since its inception twenty-five years ago. Often this has entailed the development of special purpose machines for single and multiple operations . . . to do work faster, more economically, and with a much higher degree of accuracy. Where the quantities have justified it, Ex-Cell-O has not only designed and built special machines to produce parts of improved quality but has undertaken actual production and assembly of these parts in its own plant, using to practical advantage Ex-Cell-O's complete heat treat equipment and widely-experienced production staff.

The days ahead . . . both war and postwar . . . are likely to offer a multitude of opportunities for the kind of engineering and production assistance that Ex-Cell-O can give so well. Consequently, the suggestion is made that, insofar as is practicable, *your* planning be started early. Ex-Cell-O's extensive facilities are at your disposal. Write to Ex-Cell-O in Detroit today.


Ex-Cell-O "Firsts"
EX-CELL-O was the first company in the United States to design and manufacture and introduce for successful commercial use...
...a precision ball bearing internal grinding spindle
...a horizontal-type precision boring machine
...a precision thread grinding machine
...a precision cylinder boring machine
...a 1½ horsepower compact hydraulic power unit
...a Diesel fuel injection pump and a universal-type Diesel engine nozzle
...a machine to form and fill automatically square paper milk bottles in the dairy
EX-CELL-O was also the first American company to undertake the mass production of hardened and ground precision parts for aircraft engines.

EX-CELL-O CORPORATION • DETROIT

An Ex-Cell-O 25th Anniversary Book, illustrated above, has just been printed. If you would like a copy just write to Ex-Cell-O Corporation, 1200 Oakman Boulevard, Detroit 6, Michigan.

SPECIAL MULTIPLE WAY-TYPE PRECISION BORING MACHINES • SPECIAL MULTIPLE PRECISION DRILLING MACHINES • PRECISION THREAD GRINDING, BORING AND LAPPING MACHINES • BROACHES AND BROACH GRINDING MACHINES • HYDRAULIC POWER UNITS GRINDING SPINDLES • DRILL JIG BUSHINGS • CONTINENTAL CUTTING TOOLS • TOOL GRINDERS • DIESEL FUEL INJECTION EQUIPMENT • R. R. PINS AND BUSHINGS • PUREPAK MILK CONTAINER MACHINES • PRECISION AIRCRAFT AND MISCELLANEOUS PARTS

two lines of production simultaneously.

"A SLAP in the face for our patriotism" was the bitter and incongruous comment of Michael Costello, secretary of the Puget Sound Council of AFL Lumber and Sawmill Workers Union when the War Labor Board rejected for a second time a petition for wage increases in the industry.

"The National War Labor Board has caused more stoppages in production and more dissatisfaction than all the unions in the United States—John L. Lewis included," continued Mr. Costello. "It's not the operators we want to fight—it's the enemy across the sea. But the operators don't look at it that way. They're still worrying about their profits. . . . We are not going to take this slap in the face lying down."

Labor leader Costello was speaking for some 55,000 mill workers, among approximately 130,000 employed in lumber operations in the Pacific Northwest. Unions had asked for $1 a day bonus and a change in vacation pay grants in addition to a straight hourly wage increase to $1.02½ and $1.05 per hr. A wildcat strike six weeks ago paralyzed lumber activity in five Northwestern states when WLB turned down the first request for upward revision in the fir and pine industry.

From southern California Lew Michener, West Coast director of the CIO United Auto Workers, hastened to Washington to testify before the Senate Military Affairs Committee seeking "a full postwar program for joint labor-government-management action to assure adequate reconversion and employment in the aircraft industry." He and UAW Vice President Richard T. Frankensteen state that they represent 25,000 aircraft workers in the Los Angeles area. They charge that 30,000 workers have been "driven out of the West Coast aircraft industry in the last 90 days by forced terminations" and that "accumulative evidence of the last two weeks shows that the West Coast aircraft industry has embarked on a general policy of wage cutting and forcing job terminations among women, Negroes and older employees." Among their requests are severance pay of four weeks' wages for workers employed over six months but less than a year and eight weeks' pay for workers employed over a year. North American recently broke off negotiations with one local when the union asked for severance pay on a sliding scale of 2 weeks to 28 weeks similar to the Newspaper Guild program.

War Manpower officials announce a labor deficit of 30,394 in the Los Angeles area, including 3588 in aircraft. Discussion of severance pay and benefits and protection to unemployed workers seemed premature under a proclaimed "Win-the-War" program, while a desperate manpower deficit still exists.

It was authoritatively reported from San Francisco by the Research Department of the local Chamber of Commerce that the following are current wage and hour averages in the bay area:

Average hours worked per week:	45.1
Average hourly earnings:	$1.32
Average weekly earnings:	$59.53
Total manufacturing employment:	252,600

An acute shortage of fuel is in prospect for Washington and Oregon this coming winter, more serious than the critical situation the past two years. Industrial plants and households are being urged to plan on coal as a cushion for dwindling short reserves of fuel oil, wood and sawdust. The situation was not improved by simultaneous reports that 300,000 barrels of fuel oil have been set aside for the new shell casing plant of the Kaiser Co., Inc., at Fontana, Cal., where propane or liquid gas is available as a fuel substitute if something like $350,000 worth of additional facilities are installed and an increase in operating costs of $20,000 is provided.

* * *

• **A suspension order** prohibiting any purchase or sale of steel products for six months, until Dec. 31, has been issued by the WPB Regional Compliance office at San Francisco against the Rosenburg Iron & Metal Co. Evidence at a hearing disclosed that the firm had placed orders for more than 600 tons of steel without WPB authorization and, last fall, had delivered approximately 175 tons without authorization or permission.

* * *

• **A four day contract** termination training course for war contractors and suppliers is being held at San Francisco July 11 to 14, arranged by the Western procurement district of the Army Air Forces Materiel Command and participated in by Ordnance, Chemical Warfare, Maritime, Navy and other government procurement and contracting officials. It is proposed to discuss detailed procedure and have available ranking officers to answer questions. In announcing the arrangements it is definitely specified that there is no implication of current curtailment or of the completion of war work in the far western area.

* * *

• **California's State Chamber** of Commerce has declared that it will oppose any proposal to establish a mandatory ceiling on income, estate and gift taxes through amendment to the United States Constitution. This has particular reference to the current proposal to amend the Federal Constitution so as to provide a 25 per cent rate ceiling on federal taxes except in time of war. In spite of the fact that legislatures of 17 states have already passed resolutions petitioning Congress to call a national constitutional convention to consider this proposed federal tax limitation, the California body representing business and commerce regards the method advanced through this proposal to be economically and governmentally unsound, even though in general it favors tempering the effects of excessive taxation.

. . . Cited for Awards . . .

• • • **The following companies** have been awarded the Army-Navy E for excellence in war production:

American Red Cross, Blood Donor Center, Oakland and San Diego, Cal.
Clopay Corp., Main Plant, Cincinnati.
Electro-Voice Mfg. Co., Inc., South Bend, Ind.
Ethyl-Dow Chemical Co., Kure Beach Plant, Wilmington, N. C.
General Engineering Works, Chicago.
General Motors Corp., Chev-Bay City Division, Bay City, Mich.
Goodyear Tire & Rubber Co., Goodyear Decatur Mills, Decatur, Ala.
Hexagon Tool & Engineering Corp., Dearborn, Mich.
Kewaunee Shipbuilding & Engineering Co., Kewaunee, Wis.
Harry Lang Co., Harry Lang Mfg. Co., River Falls, Wis.
H. W. Loud Machine Works, Pomona, Cal.
National Gypsum Co., Niles, Ohio Plant.
Rheem Mfg. Co., New Orleans Plant, New Orleans.
Schaible Co., Cincinnati.
Steel Products Engineering Co., Springfield, Ohio.
I. Stern & Co., Inc., New York.
Tri-Clover Machine Co., Kenosha, Wis.
Vanco Machine & Engineering Co., Grosse Pointe Park, Mich.
Vandercook & Sons, Chicago.
York Corrugating Co., York, Pa.
Southern Aircraft Corp., Garland, Tex.
Lufkin Rule Co., Saginaw, Mich. (second star)
Blackhawk Mfg. Co., Milwaukee. (star)
Hubbard Spool Co., Chicago.
Whiting Corp., Harvey, Ill. (second star)
Chicago Bridge & Iron Co., Chicago.
Federal Electric Co., Inc., Chicago.
Henry C. Grebe & Co., Inc., Chicago.
Harper-Wyman Co., Chicago.
Independent Pneumatic Tool Co., Aurora, Ill. (third star)
H. M. Harper Co., Chicago. (third star)

READY TO TACKLE *YOUR* PROBLEMS *with* OIL HYDRAULICS

You'll find the evidence all about you—oil hydraulics is moving rapidly into almost every phase of the industrial picture. It is setting a fast pace for new and improved ways of getting things done *better*. If you haven't already had occasion to note this trend, or to take advantage of it in your wartime production, your postwar planning will bring it sharply into focus.

The *reason why* hydraulic power is so much better for so many jobs is simple enough: oil under pressure can be applied to almost any power need to give *stepless* speed variation; *constant* speed control; shockproof starting, stopping and reversing; *direct* and *instant* control of power or movement; *uniform* power in any direction, in rotation, or in operating sequences; many other similar advantages.

Knowing *how* to apply oil under pressure to achieve the right combination of advantages for each job is not quite as simple. But Denison HydrOILic Engineers have solved so many new problems in this field — for so many different industries and over so many years — that they have reduced this important "know-how" to an almost exact science.

In making these technical advances, Denison has proved the advantage of *complete oil hydraulic service*, from expert analysis of individual requirements to installation and initial operation of the HydrOILic equipment that meets them.

You are invited to avail yourself of this specialized experience. No matter how vague or how concrete your immediate and postwar planning may be, now is the time to begin discussing HydrOILics in terms of your particular needs. Write today.

The DENISON Engineering Co.
1158 Dublin Rd., Columbus 16, Ohio

HUNDREDS of production jobs and special operations are handled with HydrOILic Equipment — in wartime and peacetime industry alike. Among these tasks are assembling, straightening, broaching, conveying, extruding, crimping, loading, lifting, handling, hauling, hoisting, tilting, testing, turning, pushing, pulling, packing, pressing, indexing, rotating. Let Denison Engineers help you determine how, and HOW MUCH, HydrOILics can help you.

Industry's Right Hand

DENISON
EQUIPMENT *in* APPLIED
Hydr OIL ics
TRADE-MARK

PERSONALS

FLOYD T. HAGUE, assistant to the vice-president, Steam Division, Westinghouse Electric & Mfg. Co.

• **Floyd T. Hague** has been appointed assistant to the vice-president, Steam Division, Westinghouse Electric & Mfg. Co., Philadelphia. He will serve as engineering consultant and will act in the same capacity for all departments of the division. **C. B. Campbell** has been named manager of engineering, succeeding Mr. Hague, and **J. S. Newton** has been made assistant manager of engineering. Mr. Hague has been with Westinghouse for 33 years, serving in the Power Engineering Department and as manager of the Direct Current Engineering Department until his appointment in 1938 as manager of engineering of the Steam Division.

• **Harry I. Askew** has been appointed district sales manager, Universal Division, Detroit, for Universal-Cyclops Steel Corp., Bridgeville, Pa.

• **Carl J. Dinic** has been appointed assistant to the president of the American Locomotive Co., New York. Mr. Dinic was formerly with U. S. Steel Corp. of Delaware.

• **Henry H. Ritchotte** has been appointed manager of the Contractor's Tool Division, Independent Pneumatic Tool Co., with headquarters in Chicago. He will be in charge of distributor policies and appointments through district managers.

• **W. K. Hyslop,** former vice-president and general manager, has been made president and general manager of the Massey-Harris Co., Racine, Wis.; **J. M. Harris,** former sales manager, has been made vice-president and assistant general manager.

• **Max Powell** has been appointed vice-president in charge of technical research for Harvill Corp., Los Angeles. Mr. Powell also retains his former duties as head of standard controls and chief metallurgist. He has been associated with Harvill Corp. for the past five years.

• **W. W. Finlay,** former general manager of the Cincinnati plant, of the Wright Aeronautical Corp. has resigned as director of industrial relations at Paterson, N. J., headquarters, to become vice-president and general manager of the Gulberson Diesel Engine Co., Dallas, Tex. **Myron B. Gordon,** vice-president and general manager of the Wright Corp. at Paterson has also resigned.

HAROLD T. YOUNGREN, director of engineering development, Borg-Warner Corp.

• **Harold T. Youngren** has been appointed director of engineering development of Borg-Warner Corp., with headquarters in Chicago. His duties will include supervision of Borg-Warner research laboratories, and he will cooperate with plant engineers of the 20 Borg-Warner divisions and subsidiaries. Mr. Youngren has been chief engineer, Oldsmobile Division, General Motors Corp., since 1933.

• **Thomas Rutherford** has been appointed manager of railroad and casting sales, for the Midvale Co., Philadelphia. **Truxton R. Brodhead** has been appointed Philadelphia district sales manager.

• **Robert M. Gibbs** has been made Pittsburgh regional business manager of THE IRON AGE. In 1927 Mr. Gibbs took a position with the Pittsburgh-Des Moines Steel Co., becoming advertising manager of that company the following year. In 1930 he joined the advertising department of the Jones & Laughlin Steel Corp., Pittsburgh, became assistant manager in 1936, and was promoted to manager of advertising in 1938, which position he left to join THE IRON AGE. Mr. Gibbs is a member of the Advertising Club of Pittsburgh and the Pittsburgh Chapter of the National Industrial Advertising Council.

• **Robert T. Lunceford** has been named general sales manager of the Wayne Foundry Co., Detroit.

• **C. M. Strong,** who has recently been in charge of steel buying at Ford Motor Co., has resigned to become a manufacturer's agent in Detroit. **Lawrence Trefry,** who is in charge of steel mill operations and will continue in that capacity, succeeds Mr. Strong.

• **Edward J. P. Fisher** has been appointed manager of sales, the Morrison Engineering Corp., Cleveland.

• **D. E. Reichelderfer** has been appointed assistant controller of the American Rolling Mill Co.

• **Dudley Rice** has been appointed a field engineer in the Chicago district for the Eutectic Welding Alloys Co., New York.

SAMUEL J. KORNHAUSER, president, National Tool Co., as announced in THE IRON AGE, June 29.

E. J. ZIMMER, JR., assistant to vice-president and director of sales, Rheem Mfg. Co.

• **E. J. Zimmer, Jr.,** has been appointed assistant to L. B. Keplinger, vice-president and director of sales for Rheem Mfg. Co., New York. Mr. Zimmer, in his new capacity, will concentrate on the development of sales for new postwar products. He has been continuously associated with E. I. du Pont de Nemours & Co. since 1926, having been for the past few years with Remington Arms Co., a du Pont subsidiary.

• **Jack F. Wolfram** of the Oldsmobile Division, General Motors Corp., has been named chief engineer of the division, succeeding H. T. Youngren, resigned.

• **Ivor Bryn,** general superintendent of McLouth Steel Corp., Detroit, has been appointed vice-president in charge of manufacturing.

• **Clinton W. Wood,** former Plant 4 manager at Gar Wood Industries, Inc., Detroit, has been appointed vice-president in charge of manufacturing; **Alonzo R. Ketcham,** former production manager of winch war contracts, has become production control manager, and **Henry Kvinglog** has been named general superintendent of the mechanical division.

• **Charles A. Koch,** has resigned as production engineer at the Ford Willow Run Bomber Plant and has become sales engineer of the Pollak Mfg. Co., Arlington, N. J. Mr. Koch prior to joining Ford was technical adviser to the Automotive Committee for Air Defense, and was formerly chief project engineer of Curtiss-Wright Corp.

• **James F. O'Meara** has been appointed procurement manager for the Steel International Division, Middle West Export Co., Chicago. Mr. O'Meara was formerly associated with LaSalle Steel Co., Carnegie-Illinois Steel Corp., National Steel Co., and the Central Steel & Wire Co.

• **R. V. Davies, R. B. McKee** and **Donovan Wilmot,** have been appointed assistant sales managers, Aluminum Co. of America, Pittsburgh. Mr. Davies will have charge of sales engineering and sales development activities; Mr. McKee will be in charge of district sales offices and all direct selling activities, while Mr. Wilmot has been placed in charge of product manager activities and warehouse distribution.

• **H. O. Teeple,** chemical engineer, has joined the technical service group of the Development and Research Division, The International Nickel Co., Inc., New York. He will specialize in corrosion problems.

• **David M. Kelly** has been appointed to the engineering staff of the John C. Dolph Co., Newark, N. J., in charge of the Industrial Service Division. He was formerly associated with the I. T. E. Circuit Breaker Co., Philadelphia.

• **George F. Getschman** has been appointed district sales manager of the Midwest territory for the Rolled Thread Die Co., Worcester, Mass.

• **Frank W. Shipley** has been made foundry manager of Caterpillar Tractor Co., Peoria, Ill., succeeding **M. J. Gregory,** who has resigned.

• **John J. Prochaska,** for several years Cleveland district manager for the Cleveland Automatic Machine Co., has been appointed general sales manager to succeed **George A. Collier,** who has resigned to devote his time to personal interests. **V. J. Hannon,** formerly chief of general accounting at Camco, has been promoted to Cleveland district manager.

• **Lloyd E. Kennedy** has been elected vice-president in charge of financial and related policies of Deere & Co., Moline, Ill. **B. H. E. Gill** has succeeded Mr. Kennedy as secretary and treasurer and **E. F. Curtis** has been made comptroller.

• **Martin A. Moore** controller of Hyatt Bearings Division, General Motors Corp., has been elected president of the National Association of Cost Accountants.

• **A. C. Teetsel** has been made manager of friction materials manufacturing, Thermoid Co., Trenton, N. J.

SAMUEL D. LEMMON, assistant engineer of tests, Lukens Steel Co.

• **Samuel D. Lemmon,** who has been research metallurgist for Lukens Steel Co., Coatesville, Pa., has been appointed assistant engineer of tests for the company. Mr. Lemmon entered the employ of Lukens Steel Co. in 1939 as an observer in the Research Department, and became a metallurgical investigator in 1940. He was appointed research metallurgist in 1943.

OBITUARY...

• **Daniel C. Green,** chairman of the board and chief executive officer of the Cleveland Pneumatic Tool Co. and its wholly-owned subsidiary Cleveland Pneumatic Aerol, Inc., manufacturers of aircraft landing gear, died July 2. Mr. Green had been made board chairman of Cleveland Pneumatic at the request of the War Production Board, shortly after the death of L. W. Greve. He accepted the position with the company in 1942 purely as a war assignment. In 1943 he had been named company president.

• **Adolph G. Logemann,** 88, pioneer hydraulic press and pump manufacturer and head of the Logemann Brothers Co., Milwaukee, died at his home there June 25.

• **Benjamin J. Harlan,** 50, general manager of the Lone Star Steel Co., Daingerfield, Tex., died June 27. Before going to Daingerfield last year Mr. Harlan was superintendent of blast furnaces at Bethlehem Steel Co., Lackawanna, N. Y., for 14 years.

Fatigue Cracks . . .

BY A. H. DIX

Small Gun, Loud Pop

• • • Your crusade for plants to identify themselves is not so hot. Take a run up through my part of the country and you will be positively dismayed to see the small size of the plants that produce such worldwide products as Phillips Milk of Magnesia (it was a mere converted private dwelling until a few years ago), Pond's Extract, Boston Garters, and I could go on.

The fact is that advertising builds things up to a tremendous, shadowy size in the public mind. So your plan for neon-lighted plants is something like a girl wearing tight sweaters and nylon stockings. They may reveal unexpected treasures or may merely call attention to lamentable deficiencies.

—*Deac*

"Deficiencies" is too strong a word. The product may be such that great quantities can be turned out in small plant space. Where the plant cannot measure up to the image built up in the public mind, the smart thing to do is to take down the signs, remove the street address from letterheads, and operate from the seclusion of a post office box number. We recall how let down we were many years ago when we made a turn in a Connecticut road and came upon the disappointingly modest home of Packer's Tar Soap. We were almost persuaded to give our dandruff free run.

But the land is full of plants of noble facade, situated on well-traveled railways or highways, that have capitalized inadequately or not at all on the publicity value of their locations. It is with them that our crusade is moderately concerned. We say "moderately" because we have seen instances where management has become so plant proud that dandelions in the plant lawn create greater concern than weeds in product design and sales promotion.

Stoppers

A Little Squirt Saved a Fortune in Gas—**Dresser Industries.**

The black widow carries a deadly sting—**Foote Bros. Gear and Machine Corp.**

Listen Hermann, Never say NEVER!—**Lincoln Electric Co.**

Aptronym

You were kind enough recently to announce on your Free Literature page our new Bulletin 806. Among those who inquired for it was M. H. Drinkwine, Chief Engineer of the Hoffman Beverage Co., Newark, N. J.

—*J. H. Roush, Advertising Manager, The Marley Co., Kansas City, Mo.*

One "Ta" Many

A recent headline of yours reads "NAVY DEVELOPS RUST PREVENTATIVE." Ta! Ta! Is this what the book says?

—*George R. Woods*

Our drugstore dictionary lists only "preventive." But unfortunately the brains department has access to one of those big jobs that permit a choice. We are making up a new style sheet, and if anyone holds out for "preventative" we will ask him to pronounce it after the third Scotch.

Unsteady Hand on "2" Bar

• • • This week our readers are extra-critical, probably due to the heat. A. W. Miller complains because on page 47 of the June 29 issue a furnace is mentioned as being 8 ft. 22 in. long. "Is this," he asks, "a fancy way of saying 9 ft. 10 in.?" No, it was merely a linotypical stammer for 8 ft. 2 in.

Hyphen Pogrom

• • • The same critic says:

All through the issue you use "nearby." There is, dammit, no such word.

There is in our book, but it is hyphenated—"near-by." The brains department is currently engaged in a hyphen pogrom, and if you walk through its domain on a late Tuesday, when forms close, you will find the floor knee-deep in hyphens.

But not all are hyphen-phobes. The other day we watched a member of the brains department edit a manuscript and he was actually adding hyphens. The word "nonaging," for example, will greet your eyes as "non-aging" when it appears in an early article.

We think the brains department is right in both instances. "Nearby" is superior to "near-by," and nonaging" is better than "nonaging." Our only hope is that the hyphen be restored to "infra-red," because we always mentally pronounce it as two syllables when it appears as infrared."

Heat Lost in Transit

• • • On the credit side of the ledger there is this week an uncommonly large number of friendly backpats administered in routine letters from readers. The conventional gages of readers' fervor—circulation growth, subscription renewals, and reader preference surveys—are the most accurate, but being of a statistical nature, they throw light without heat.

We are, therefore, pleasantly warmed by a complimentary postscript or a bouquet scribbled on a subscription bill. But when, in our pride, we pass them on to you, they seem to lose their heat, and sound as if the writer's hand were inserted in one of those old-fashioned letter-copying presses and as if we had turned the screw to the bone-crushing point. These are samples of what we mean:

"THE IRON AGE is read regularly and with great interest."
"I do enjoy the magazine very much."
"I consider it to be the leader in its field."
"Your journal is widely read in this part of the country."

We grant that they do not sound like involuntary outbursts of full hearts, and even to our biased touch they have cooled to room temperature, but we remind you that this is a technical journal, read by men who are accustomed to allow a large margin of safety, although once one of them did forget himself and write us, "THE IRON AGE is part of our lives."

Diluted Briton

• • • An English air official we met the other day said he has been on duty in this country so long that his friends now refer to him as " 'Arf-and half."

Model "T" Complex

• • • A situation wanted advertiser in the New York *Times* lists among his virtues "the ability to interpret management thinking to plant, community and consumers."

Although the statement flatters management, we think it will stand in the way of the advertiser getting a job, for astute managements realize that when the normal state of greater supply than demand returns what will be needed will be a man who can interpret consumer thinking to management. The consumer cares next to nothing about what the management thinks, as Ford found out when the Model "T" outstayed its time.

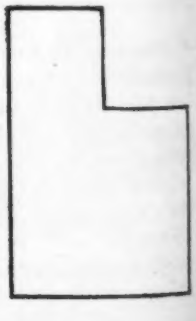
Puzzles

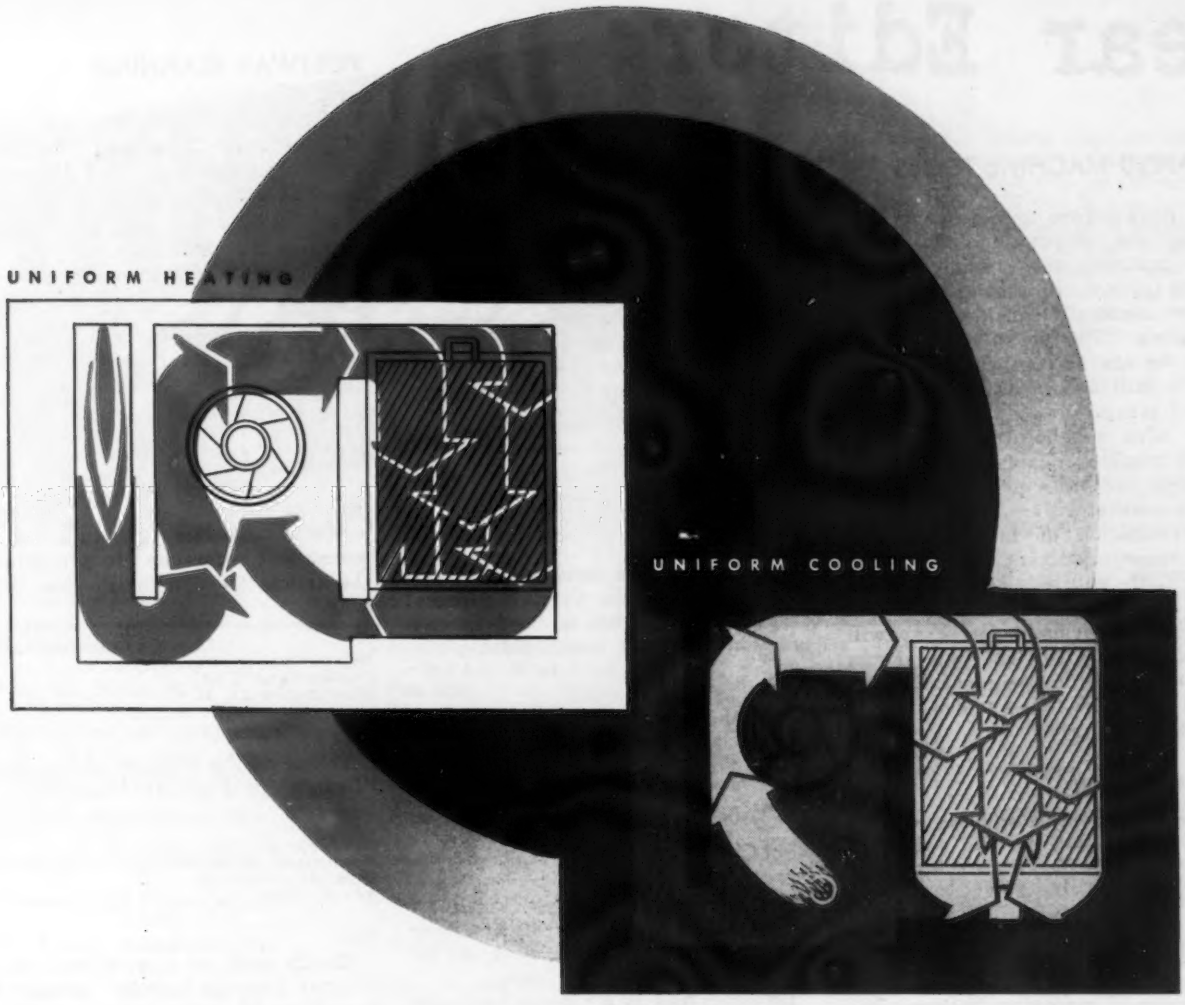
Last week's puzzle is solved thus:

$$31 = 3^3 + 3 + \frac{3}{3}.$$

A. A. Mol sends this in:

A shop has a piece of scrap plate shaped as shown in the illustration. The problem is to make two straight cuts through the plate so that the pieces can be welded into a square.





Cycle heating *and cooling* is positive with the Lindberg *Super-Cyclone*

Most versatile furnace in the heat-treating industry, the operating principle of the Lindberg Super-Cyclone allows accurate control of cooling as well as heating. For cycle-heating and cooling, an "automatic program control" can be set up for entire operations without the charge being withdrawn from the furnace.

The amazing Lindberg principle of fan driven hot air from an isolated heat source makes such flexibility possible. Just as the load is evenly heated throughout with rapid uniformity, it can quickly be cooled by cutting the heat and continuing the blower. Thus air at room temperature is forced through the charge, cooling evenly every piece throughout the load.

Cycle-annealing, spheroidizing or isothermal transformation is a quick and accurate operation with the Lindberg Super-Cyclone.

After a soaking at any temperature, the automatic program control will quickly bring down the entire charge to a given temperature for another heat. This remarkable furnace does work faster with a minimum of correction, saves a vast amount of time, floorspace and man power, and provides, in the same furnace, normalizing or annealing, hardening, or tempering. Write to Lindberg Engineering Company, 2452 W. Hubbard St., Chicago 12.

ARMY E NAVY

Lindberg FURNACES

SUPER-CYCLONE for hardening, normalizing, annealing, tempering

CYCLONE for accurate, low-cost tempering and nitriding

HYDRYZING for scale-free and decarb-free hardening

Dear Editor:

SCRAPPED MACHINE TOOLS

Sir:

We have before us a problem concerning the disposition of several heavy machine tools which in the present market are unsalable as such. We are seriously considering scrapping them. The scrap dealers with whom we are in contact report that there is still a fair demand for this class of scrap.

We have reached the conclusion that it would probably be better to sell these machines as scrap on the present market rather than wait for the termination of hostilities. We are of the opinion that when the war is over there will be a tremendous influx of battlefield scrap and that, furthermore, the demand for scrap will probably take a sudden drop. From your knowledge of the general situation do you think that our conclusions are correct?

H. C. PRATT,
Equipment Sales Agent
Vermont Marble Co.,
Proctor, Vt.

● We concur in your conclusions, and believe now is the best time to dispose of No. 1 machinery cast, heavy breakable cast and heavy melting steel grades of scrap.—Ed.

TAP DISINTEGRATOR

Sir:

A means of removing broken taps by disintegrating them electrically is described on page 60 of your May 4 issue. Who makes the Elox equipment?

J. J. McCULLOUGH
McCullough Tool Co.,
5820 So. Alameda St.,
Los Angeles 11

● Elox Corp., 18273 Livernois, Detroit 21, Mich.—Ed.

BOUQUET

Sir:

I thought your June 29 editorial, "Majorities and Minorities" was very timely. Keep up the good work. Some day it may get through to the boys who sit around the Mayflower and the Wardman Park.

MACHINE TOOL BUILDER

INDUSTRIAL FILMS WANTED

Sir:

During the past winter, we sponsored a series of technical meetings for people in our neighborhood. The program was called "The South Chicago Technical Club"—no dues, no officers.

Programs covered Magnaflux, electric furnace steel making, synthetic rubber and the like. The most successful programs were those related to metals, especially steel. We used speakers from nearby plants and some from considerable distance.

Movies are particularly popular and last season we had many excellent films. The difficulty is that there is no central listing of these industrial films and they are very hard to locate. We would appreciate it if firms who have films for rent or free loan would send us a brief description of them, including title, subject, length, whether 16mm. or 35mm., sound or silent (if sound, type of recording), whether color or black and white.

We have meetings every two weeks and use about four films a month.

MARY M. TAGGART,
Technical Reference Librarian
South Chicago Branch Library,
9055 S. Houston Ave.,
Chicago 17

CRONAK

Sir:

Will you please send us all latest information on the Cronak process? We understand this is used in conjunction with zinc electroplating.

C. F. DAUM
Reese Padlock Co.,
Lancaster, Pa.

● We have published several excellent articles on the subject but your best bet is to write to the New Jersey Zinc Co., 160 Front Street, New York, for the bulletin, "Cronak Process."—Ed.

HELLCAT TAMER

Sir:

A badly damaged Navy "Hellcat," which was landed safely on a carrier deck by Ensign R. Black, is shown on page 97 of your June 1 issue.

Ensign Black is a former employee of ours and we would like to print this picture in our employee publication. Will you lend us the photograph or plate?

H. F. HEIL,
Editor
NCR Factory News,
National Cash Register Co.,
Dayton, Ohio

● This is a Press Association picture and we purchased permission to use it only in The Iron Age. However, you can doubtless obtain authority for its use by communicating with the Press Association, 50 Rockefeller Plaza, New York.—Ed.

WHERE IS E. D. SEWALL?

Sir:

You had an article in Your Dec. 21, 1905, issue by a E. D. Sewall, entitled "The Toothless Saw." As far as I know, there has been practically nothing published since that time on the friction saw that melts its way through metal.

Can you give us any information on just who E. D. Sewell was? Do you know whether he is still alive and if so where can he be reached?

W. J. McDONOUGH
300 West Adams St.,
Chicago

● No one now with The Iron Age remembers E. D. Sewall. If any reader recalls him word will be appreciated by W. J. McDonough. Newest development in friction cutting is the use of ordinary woodworking band saws, operated at high speeds, for cutting materials even as hard as armor plate. Speed is so high that the metal practically gasifies. There are no visible chips. For further information see page 64, Apr. 1, 1943, Irong Age.—Ed.

POSTWAR PLANNING

Sir:

We would appreciate tear sheets of your June 22 article, "Design for Postwar Planning," by Donald C. MacDonald.

JOHN YOUNG,
Production Engineer
Fairchild Aircraft,
Hagerstown, Md.

Sir:

Please forward the writer two copies of "Design for Postwar Planning."

C. J. GASPAR,
Lieut. USNR
Navy Department,
Office of Inspector of Naval Material,
401 Old Post Office Bldg.,
Pittsburgh 19

Sir:

We should like to obtain for our permanent reference file a reprint of the article "Design for Postwar Planning."

R. I. WHYTE,
Industrial Editor
Department of Commerce,
Publications Unit,
Washington 25, D. C.

Sir:

Please mail a clipping of the article "Design for Postwar Planning."

R. C. BATEMAN,
Manager
Goodyear Aircraft Corp.,
Production Engineering,
Dept. 38—Plant B,
Akron, Ohio

Sir:

Kindly send me a set of tear sheets of your June 22 article, "Design for Post-War Planning," by your Cleveland Editor, D. C. MacDonald.

F. R. MONAL,
Industrial Fellow
Mellon Institute of Industrial Research,
University of Pittsburgh,
Pittsburgh 13

HIGH SPEED STEEL CODING

Sir:

I am quite sure you published an article in the last few months describing the new nomenclature for marking high speed steel, adopted by some of the larger automobile manufacturers. In what issue did it appear?

ALBERT S. READWAY,
Vice President
Geometric Tool Co.,
New Haven 15, Conn.

● Jan. 13, 1944, page 67, entitled, "Tool Steel Identification System," adopted by General Motors, Ford and Chrysler.—Ed.

WELD RADIOGRAPHY

Sir:

We are interested in purchasing 50 reprints of Leslie W. Ball's article, "Radiography Applied to Welding," in your May 25 issue, to be used in an educational program we are conducting with local welding shops.

A. B. STUART,
Manager
X-Ray, Inc.,
2151 E. Congress,
Detroit, Mich.

● Because of paper restrictions we cannot furnish reprints but you have our permission to make photostats or photo-lithographed copies.—Ed.

HOW THE AIRLESS WHEELABRATOR *Slashes* CLEANING TIME

Your blast cleaning problems may present a mountain size obstacle to you . . . but you can make them vanish into mole hills by calling on American's experience. There is convincing proof in the history of thousands of cleaning applications handled by the Airless Wheelabrator that this method is earning its way by effecting unusual reductions in cleaning time, cost, manpower, and space. Check over this "fact chart" from performance reports and you can see why "In number of machines sold and variety of applications handled American leads the field."

COMPANY AND LOCATION	PRODUCT	QUANTITY OR WEIGHT	FORMER METHOD		Wheelabrator Method
			EQUIPMENT	TIME	TIME
Wyman Gordon Co., Worcester, Mass.	Aircraft crankshafts	550 lbs.	Pickling	30 min.	2 min.
Stanley G. Flagg Co., Stowe, Pa.	Pipe caps	1900 lbs.	Airblast barrel	18 min.	4 min.
American Crucible Products Co., Lorain, Ohio	Brass castings		Airblast barrel	18 hours	3 hours
Detroit Diesel Eng. Div., Detroit, Mich.	Diesel engine parts	250 parts	Suction cabinet	5 hours	5 min.
High Standard Mfg. Co., Hamden, Conn.	Rifle parts	26,522 lbs.	Airblast barrel	60 hours	16 hours
General Railway Switch Co., Rochester, N. Y.	Machine gun bases	35 bases	Airblast tables	3 hours	18 min.
Continental Motors Corp., Detroit, Mich.	Cylinder barrels		Airblast table	24 hours	3-5 hours
Henry Disston & Sons, Philadelphia, Pa.	Armorplate		Airblast room	3 hours	1 hour
John Inglis Co., Ltd., Toronto, Ontario	Heat-treated parts	6000 parts	Tumbling mills	24 hours	15 min.
Benjamin Eastwood Co., Paterson, N. J.	Gray iron castings		Airblast barrel	1 hour	6 min.
H. Belfield Co., Philadelphia, Pa.	Valve bodies		Wire brushes	8 hours	1½ hours
Wood Bros. Thresher Co., Des Moines, Iowa	Tank doors	12 doors	Airblast table	6 hours	1 hour
Pontiac Foundry & Mach. Co., Pontiac, Mich.	Gear blanks		Tumbling barrels	11 hours	3½ hours
Excello Corp., Detroit, Mich.	H. T. engine parts	9000 parts	Airblast barrels	2 hours	10 min.
American Steel & Wire Co., Worcester, Mass.	Gun forgings	150 pieces	Airblast cabinet	15 hours	10 min.
Dorn Manganese Bronze Corp., Brooklyn, New York	Brass & bronze castings		Wet tumbling barrel	40 min.	5 min.
International Silver Co., Meriden, Conn.	Garand rifle parts	2000 parts	Tumbling barrels	4-8 hours	8-10 min.
Buick Aviation, Melrose Park, Ill.	Heat treated gears	56 gears		3 hours	15 min.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.	Malleable iron caps	160 caps	Airblast cabinet	1½ days	16 min.
Superior Castings Corp., South Norwalk, Conn.	Tanks and covers	8-14 pieces	Airblast cabinet	25 min.	4 min.
Canadian Bronze Co., Ltd., Montreal, Quebec	Journal bearings	75 bearings	Sand blast room	30 min.	4 min.
Beach Foundry Co., Ottawa, Ontario	Bomb nose plugs	1000 plugs	Tumbling barrel	3 hours	15 min.
Yale & Towne Mfg. Co., Stamford, Conn.	Trolley gears	54 gears	Table	5 hours	13 min.
D. Wilcox Company, Mechanicsburg, Pa.	Annealed forgings	200 pieces	Sand blast barrel	4 hours	12 min.

American
FOUNDRY EQUIPMENT CO.
510 SOUTH BYRKIT STREET MISHAWAKA, INDIANA

WORLD'S LARGEST BUILDERS OF AIRLESS BLAST EQUIPMENT

This Industrial Week . . .

- **Steel Ingot Output Resumes Pre-Holiday Rate but Fails to Gain**
- **Order Volume Strong but Hesitancy Still Noticeable**
- **Tank Overhauling and Modernizing Program Launched**

WHILE the War Production Board, the armed forces and the steel industry focused attention on the lagging ingot rate this week, steel output barely resumed the same rate of activity which took place in the pre-holiday week. Discussions in Washington last week led to the conclusion that unless the manpower situation in the steel industry was alleviated there was little chance that the industry could operate at its maximum capacity. Added to this factor was the abnormal hot weather throughout the country which some sources claim has been responsible for the major part of the drop recently in raw steel output. Other quarters, however, are of the belief that even though the heat factor is offset the manpower shortage will continue to be the guiding hand in the future trend of steel production.

Not mentioned in official quarters but nevertheless an important adjunct to the declining steel ingot rate has been the increase in the number of so-called outlaw or "quickie" strikes in the steel industry. While the actual production loss due to these work stoppages is only a small percent of the total steel output, the effect of these unauthorized strikes is to disrupt completely the intricate steel scheduling mechanism in the industry. A prime example of this situation was the recent strike in a Pittsburgh plant where the production of freight car wheels and axles was completely stymied for several days. The full effect of this work stoppage will be felt in the last quarter of this year when freight car builders, having gained other materials such as plates and sheets, will find themselves shorthanded on axles and wheels.

STEEL ordering has increased notably during July but at the same time some sales offices feel that pressure from consumers is reducing rather than increasing as might be expected along with the large orders. This hesitancy on the part of steel users is predicated on the belief that inventories and shipments should be more closely geared with actual production than was the case several months ago before the invasion of Europe became a fact.

The War Department has cut the shell container program 60 per cent. The downward revision is due to the fact that the containers are not needed in the European theater and also to the fact that they are too heavy for that area. The cutback will effect a saving of about 100,000 tons of steel a month it is said.

Plate demand this week continues higher and the Maritime Commission has been authorized to enlarge its orders for September delivery by a considerable number of tons. The government is also attempting to increase production of shell steel billets and has advanced some of its directives. This forward movement in directing the production of such items as quality bars, semi-finished steel and rails. The reduction in the output of these items serves merely to increase the already heavy carryovers.

The WPB is attempting to balance sheet orders on various mill books by shifting some of the outstanding business. A fair amount of landing mat tonnage has been transferred from the books of one producer for example and is expected to relieve that company's carryover on hot rolled sheets. The Navy Bureau of Yards and Docks is said to be negotiating its 1945 pontoon requirements. Several makers of landing mats have also received contracts for 1945 delivery. In the export sphere the outlook for concrete bars is strengthened by the possibility of enlarged orders from South America and Mexico. If steel rail producers were capable of delivering materials, the demand for such items from South America would be considerable.

FROM Detroit comes the news that a new tank program involving the overhauling and modernizing of 2000 30-ton tanks has been launched. Chrysler Corp. at Evansville, Ind., which has been making cartridges, will be able to use at least 2500 workers on the tank program and has promised the completion of the overhauling on 1000 tanks by the end of 1944. The balance of the order is expected to be completed in the first quarter of 1945.

Movement of scrap iron and steel is sluggish throughout the country, except in the Buffalo area which is receiving barge shipments from metropolitan New York. The dull market is caused by the reluctance of steel mills to take on inventories of scrap at ceiling prices when an early termination of the war in Europe may cause cancellation of government contracts and depress scrap prices. Mills are adhering rigidly to scrap grade specifications and certain dealers are shipping at a sacrifice out of their normal market areas rather than risk rejections. Concern has been expressed for next winter's supply of scrap, for dealers are unwilling to build up their supplies in the face of an impending market drop, and the manpower shortage is seriously impeding their scrap handling operations.

The national steel ingot rate this week is estimated at 96 per cent of capacity, up one point from last week's 95. Accounting for the rise is Pittsburgh and Cleveland up three points to 92 and 93.5 per cent respectively; Wheeling up one and a half points to 98; Birmingham up 13 points to 97 from last week's revised rate of 84; Detroit up five points to 101; Southern Ohio River up 11 points to 98, and the West up eight points to 94.5. Chicago dropped a point to 99 per cent; Youngstown dropped five to 95; Philadelphia is down one point to 98.5, and the Eastern rate dropped seven points to 83. Remaining unchanged are Buffalo at 104.5 and St. Louis at 99 per cent.

• **STEEL STRIKES**—Although WPB and the Armed Forces had a full dress meeting last week with the Steel Industry Advisory Committee nothing was publicly mentioned about the loss of steel incurred by strikes. The industry was lectured on various ways to alleviate the manpower shortage along with other suggestions most of which have been exploited for some time by steel companies. The loss in steel output and more important the jamming up of intricate steel schedules by outlaw strikes at steel plants seems to worry no one except steel production men who want to get the tonnage out. The WPB has a labor expert in its organization but apparently any interference by WPB into the "quickie" strike situation is not looked upon as "proper". In recent weeks far-reaching difficulties have been posed by steel strikes which seem to be on the increase as the rank and file become restless over the long drawn out WLB hearings.

• **HEAT, EXHAUSTION and MANPOWER SHORTAGE**—The WPB places the loss in steel output due to heat, exhaustion and manpower shortages at about 500,000 tons a month. Steel industry representatives said that the drop in steel ingot production is due to a manpower deficit of about 40,000 to 50,000 employees. This deficit has meant that steel workers have had to put in a 16-hr. day many times and as much as a 57-hr. week. Some sources think that of the total loss in steel output, which is said to be running about eight per cent, five per cent is due to heat with three per cent due to manpower shortage. These views are subject of discussion among steel people.

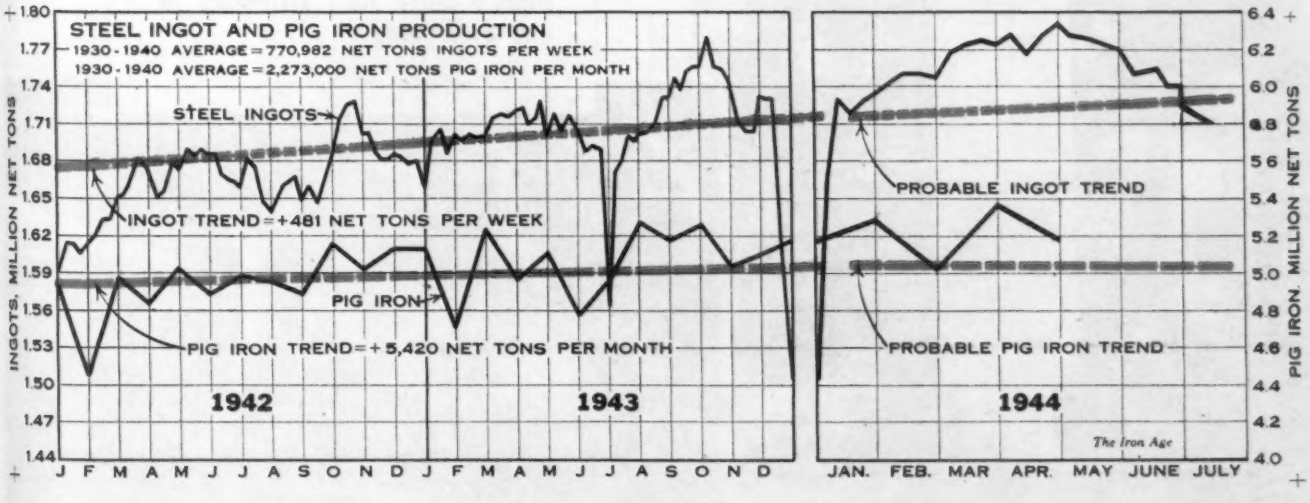
• **TRUCKS**—Contrary to earlier reports, the truck industry expects to fill its 1944 quota of 101,000 trucks for essential civilian use, according to C. T. Ruhf, president of Mack Trucks, Inc. The civilian truck total was raised to 101,000 from 88,000 following recent cutbacks in military truck production. The cutback, spread over the entire industry, was greater than the subsequent increase in the civilian truck quota. During the first four months of this year, the industry produced 18,039 trucks for civilian use and more than 200,000 trucks and truck tractors for the armed services.

• **SURPLUS MATERIAL**—Although a deal has been completed, as described earlier, for Metals Reserve Co. to handle surplus aircraft materials, differences have arisen over details of the plan. The Army Air Forces want MRC to handle only currently usable surpluses, and to eliminate obsolete surpluses from the plan, apparently in fear that the MRC warehouses will become so clogged with obsolete materials that handling will be complicated all along the line. MRC feels it should handle all materials, whether surplus or not, on the grounds that differentiation would make a complication of difficulty.

•**SHELL CONTAINER CUT THREATENS**—There are reports that the shell container program may be cut back instead of being increased. Meetings are being held this week in some centers when the subject will be discussed. The purpose of the possible change is thought to be that of saving steel sheet which is overloading strip mills. First contracts were let for shell containers in March for delivery during the third quarter. New contracts were set to be released in July for delivery in the fourth quarter and first quarter of next year. Expectations are that the first contracts will be stretched into later deliveries and that the new contracts will be delayed for the time being. Availability of equipment to make the shell containers is said to be one drawback. However, the condition of the sheet market in the next few months will probably be the determining factor as to whether or not the program will be spiked.

• **MAY PRODUCTION**—May was a month of exceedingly high production of certain types of war goods. Aircraft weight output was 102,418,000 lb., for 8902 ships. May was the biggest month in Naval construction history, with landing vessel builders turning in the most spectacular performance, delivering 198,000 tons or 10 per cent more than scheduled. Heavy artillery production (over 105 mm.) ran 26 per cent over April production and four per cent ahead of schedule. While Maritime shipbuilding dropped three per cent from April, it was one per cent over the schedule.

• **AUTOMOBILES SOON?**—Automobile executives this week will know whether or not they will get their sailing orders on the reconversion plan for the nation's biggest industry. The meeting with WPB is set for July 14 and it is anticipated that the reconversion set up will be definitely outlined. In the past two weeks the various automobile companies have submitted briefs to the WPB outlining their views on reconversion. At any rate this get-together is expected to bring a better "meeting of the minds" than one held previously.



Steel Ingot Production by Districts and Per Cent of Capacity

Week of	Pittsburgh	Chicago	Youngstown	Philadelphia	Cleveland	Buffalo	Wheeling	South	Detroit	West	Ohio River	St. Louis	East	Aggregate
July 6	89.0	100.0	100.0	99.5	90.5	104.5	96.5	84.0*	96.0	86.5	87.0	99.0	90.0	95.0
July 13	92.0	99.0	95.0	98.5	93.5	104.5	98.0	97.0	101.0	94.5	98.0	99.0	83.0	96.0

* Revised

MESTA

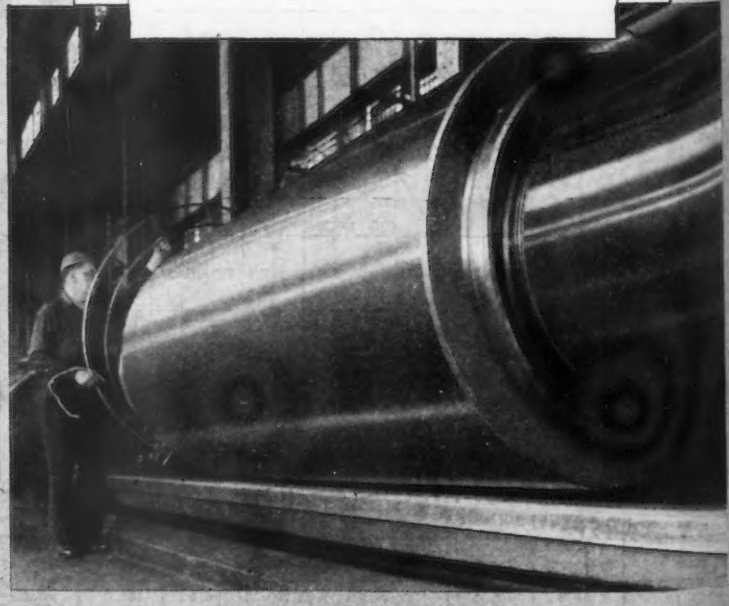
SPECIAL ALLOY CAST STEEL BACKING-UP ROLLS

Rolls are cast in the Mesta Foundry from molten steel produced in our own Open Hearths...

Mesta engineers, metallurgists and foundrymen have devoted their entire careers to the production of rolls for the hot or cold reduction of ferrous and non-ferrous materials. To assist them in producing rolls of the highest quality to accommodate the rolling conditions in each individual mill, these men have at their disposal all the necessary equipment and materials from which to make the proper selection. There is a Mesta Roll for every type of service.

After annealing and rough turning, these rolls receive further heat treatment to produce the desired hardness...

Finishing is done in Mesta Heavy Duty Roll Grinders in our own shop.



The Army-Navy "E" Flag with four stars, flies over the Mesta plant

MESTA MACHINE COMPANY • PITTSBURGH, PA.

Government War Agencies Focus Attention On Problems of the Foundry Industry

Chicago

• • • **Production delays** in critical programs attributable to gray iron castings have focused the attention of the major war agencies upon problems of the foundry industry, members and guests of the Gray Iron Founders Society, Inc., were assured at a manpower-price control conference here July 6.

Although representatives of the industry laid their case before attending government officials with facts and figures, some delegates expressed the belief that the federal representatives had offered little tangible help in solving the manpower and price problems which are plaguing the foundries.

William B. Murphy, deputy vice-chairman for Production, War Production Board, and co-chairman of the National Foundry and Forge Shop Committee, declared that the tonnage of gray iron castings produced to date was 15 to 20 per cent over last year, but that an additional increase of 20 to 25 per cent was necessary to meet program requirements. He expressed particular concern for the heavy truck program, which he said in June was 32 per cent behind schedule. Seventy-five per cent of this lag he attributed to shortage of gray iron castings. This month, he said, a 25 per cent increase in heavy truck production is programmed, and that some means must be found to enable the critical foundries to meet the challenge.

Directives are now being used in substantial numbers to lay production emphasis on critical castings, the WPB official revealed. "Topside attention" is being given to the casting production problem by WPB officials and those of other government agencies and the armed services. He stated that arrangements had been made for prominent military figures to send messages to foundry workers emphasizing and explaining the importance of their work, that morale caravans had been arranged, and that movie shorts were being prepared. He urged the foundries to better the situation by emphasizing critical production, more intensive recruiting, training programs, improved labor relations, greater employment of women, better preparation and better selling on OPA and WLB cases, increased mechanization, and improving morale. As to mechanization, he said that WPB stood ready to help the foundries get approval of full amortization provisions wherever they are justified.

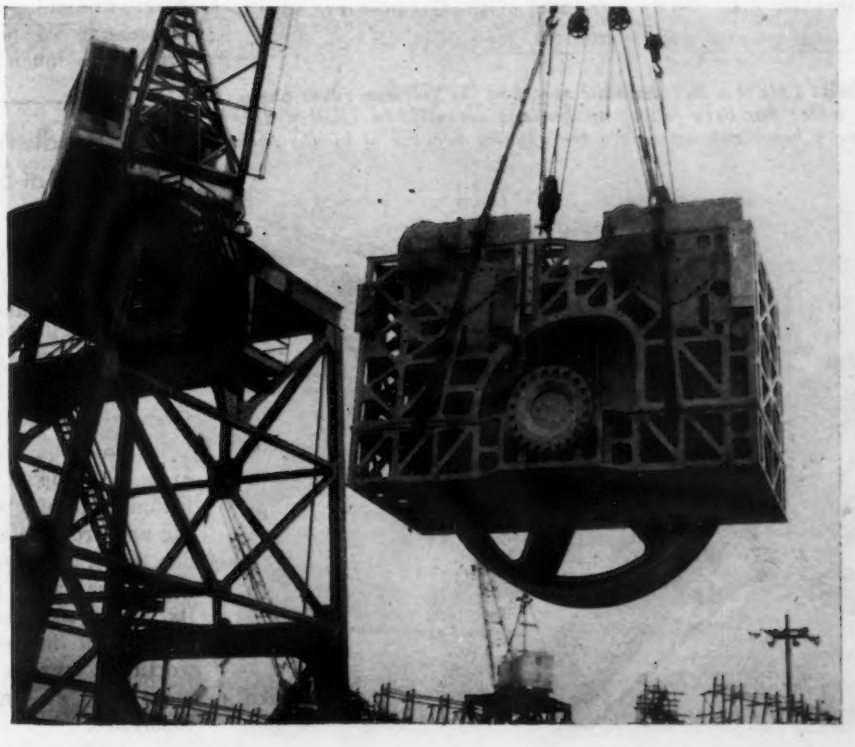
Joseph D. Keenan, vice-chairman for Labor Production, WPB, and a member of the National Foundry and Forge Shop Committee, averred that the "A-1 necessity in this program is to improve human relations" and urged the foundries to "sell the job to the employee, pointing out the importance of the product he is making." He underlined the importance of improved working conditions and equipment, and declared that WPB is working with the War Labor Board to have foundry cases expedited.

George W. Cannon, president, Campbell Wyant and Cannon Foundry Co., Muskegon, Mich., presented the industry's viewpoint. He declared that if permitted to work at plant capacity, the industry is capable of meeting vastly increased demands for both military and civilian requirements even though tremendous production strides already have been taken. Production of castings this year is expected to decline to less than 12 million tons from a 1942 peak of 14.5 million tons.

The situation is acute for a limited section of the industry, mainly those producing automotive castings. "It must be kept clearly in mind," he said, "that only one out of 19 gray iron foundries are on government's seriously critical list."

Citing a survey of 1971 foundries taken by the society, Cannon said that over 90 per cent of them named manpower as the industry's number one problem. A need for 22,581 additional men, and the possible use of 6727 additional women was brought out by the survey, but a personal canvas in June showed that 1532 additional men would create maximum production. Tossing the ball back to the government, he declared that "recruiting efforts have been seriously handicapped by the government restrictions and adverse publicity by various government officials." He produced evidence to show that the industry's wages compare favorably with other manufacturing plants, that the work is interesting and that the normal turnover rate is

REDUCTION GEAR: *An 80-ton reduction gear is lifted from a specially built flat car to be installed on a merchant ship hull at the Vancouver shipyard. The entire procedure, from the time the gear was lifted from the car until it was in place only took 45 min.*



below average. OPA price ceilings were characterized as seriously handicapping the industry and allowing no margin for increased mechanization or additional improvement of working conditions to insure war production which the preceding speakers had asked.

He recommended that the War Manpower Commission raise the industry's position on its critical list, divert Mexican labor to the foundries, encourage the use of women, divert the manpower surplus from other plants to the foundries, foster draft liberalization, and inaugurate "vestibule training programs." In the production of automotive castings, now considered "desperately critical," he urged necessary steps to aid large automotive manufacturers to open and increase the production of their foundries and also the opening of other captive foundries. Murphy, speaking for the WPB, indicated that this was being done.

Discussing "sound costing—a sound pricing fundamental," William M. Caldwell, assistant to the Society's executive vice-president, drew upon his experience as an OPA official to state that less than 25 per cent of the industry knows its costs on individual castings. In considering requests for price relief, the OPA insists that unit costs be shown. Moreover, he stated, competition will demand sound cost determination.

Representing the War Manpower Commission, Dean William H. Spencer, director of Region 6, said that the next three to six months may very well be the most critical since the beginning of the emergency from the standpoint of manpower. He cited special recruitment programs being undertaken locally for the foundries based on cooperative arrangements between the management of local foundries, local training agencies and the United States Employment Service. In one such program in Milwaukee it was learned that recruiting was complicated by an unduly high percentage of workers referred by the Employment Service not reporting to the foundries for employment or refusing the job after reporting, and by rejection by the foundries of an unduly high percentage of employment service referrals.

Dean Spencer decried the "peace psychosis" of the public as exerting a demoralizing effect upon the mobilization of manpower and womanpower for war industries. Practical recommendations to assist local foundrymen in their hiring programs were listed.

W. W. Welfling, chief, Gray Iron and Malleable Castings Section, OPA, defended his agency's pricing policies. Although the industry's profit margin has been cut by rising costs, he declared that the overall profit showing in dollar volume was still favorable. Defense was offered for use of the 1936 to 1939 base period as a yardstick for reasonable profits. Cases of individual hardship may be adjusted under the agency's procedures, he said.

Outlining the industry's view of the price control situation, C. B. Magrath, president of the Greenlee Foundry Co. and North Western Foundry Co., Chicago, and member of the OPA Industry Advisory Committee, took exception to certain of the agency's pricing policies. Use of the 1936-1939 base period was particularly hard on the jobbing foundries, whose business was in poor condition in those years, he said.

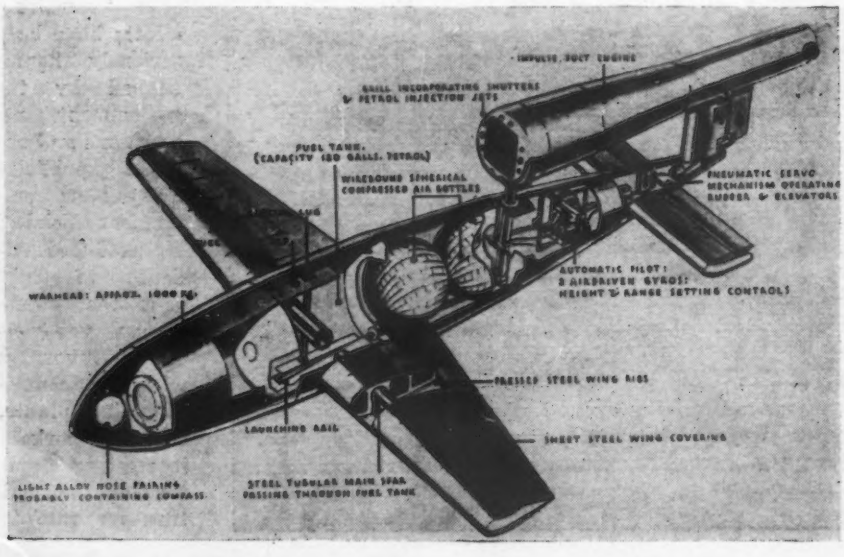
Development of price regulations was hobbled by "woeful lack of statistics," and complicated by the tailor-made character of the industry's products.

He attached the base period pricing method by which wage raises must come out of profits as being unfair to some foundries and urged that the formula method be permitted in all cases.

He also differed with OPA on relief procedures declaring that the four per cent profit peg by which adjustments are charted was the average of a statistical sample which did not represent the industry and was based on an unrepresentative calendar period.

He pointed out that profits of jobbing foundries drop 10 per cent for each four per cent drop in production if 60 per cent of capacity is their break even point. If their break even point is 50 per cent, a 10 per cent profit drop will result from a five per cent cut in production. For this reason, he said, minor variations in production have too great an influence to make it possible to accurately estimate a four per cent profit. On short runs, it was declared that the foundries cannot get relief because the processing of price applications requires too much time.

NAZI ROBOT BOMB: *This is a diagrammatic sketch of the German robot bomb, or rocket plane, which has been falling on England recently. In London, this week, children were being evacuated into the country because of bombs such as this.*


IMPULSE DUCT ENGINE
SHELL INCORPORATING SHUTTERS & PETROL INJECTION JETS
FUEL TANK (CAPACITY 150 GALLS. PETROL)
WIREBOUND SPHERICAL COMPRESSED AIR BOTTLES
PNEUMATIC SERVO MECHANISM OPERATING RUDDER & ELEVATORS
AUTOMATIC PILOT: 2 AIRDRIVEN GYROS: HEIGHT & RANGE SETTING CONTROLS
WARHEAD: APPROX. 1000 LB.
PRESSED STEEL WING RIBS
LAUNCHING RAIL
SHEET STEEL WING COVERING
LIGHT ALLOY NOSE FAIRING PROBABLY CONTAINING COMPASS
STEEL TUBULAR MAIN SPAR PASSING THROUGH FUEL TANK

Dresser Industries Acquire International-Stacey Corp.

Columbus, Ohio

• • • **Dresser Industries** will acquire financial control of International-Stacey Corp. and subsidiaries in a step designed "to enlarge postwar participation in oilfield equipment potentials," H. N. Mallon, president of Dresser disclosed.

International-Stacey and subsidiaries, a group of six companies, is a leading manufacturer of oilfield drilling and production equipment sold under the trade name "Ideco." Dresser Industries, with seven companies in its group, supplies related equipment to the oil industry. Dresser's net worth is approximately $10,000,000 and that of International-Stacey, $5,000,000.

Manpower Priority for Foundries As Recruitment Program Gets Underway

Washington

• • • **Given top priority** ratings for employment, WMC Chairman Paul V. McNutt has announced a recruitment program for 15,000 to 20,000 workers in foundries and forging plants under the priority referral system, which became effective July 1. USES will channel to the foundries all available applicants for jobs who have had experience in such work or who believe they can do the work. Mr. McNutt said that the call for these workers grows out of a joint program agreed upon by WMC and WPB to bring about an increase in production necessary to meet war requirements.

Men identified with the industries have indicated to WMC officials that the scarcity of male workers today is due not so much to dissatisfaction with current wages or the character of the work as to the fact that many men found work in industries other than foundries during 1940 and 1941. It was not until 1942, WMC said, that the forge and foundry industries began to have a top place in the war effort.

Most of the plants for which recruiting will be done are in the Great Lakes states, in New England, New York, Pennsylvania and New Jersey. The plants for which men are needed most urgently and for which the utmost effort will be made to find workers number approximately 300. These are the plants certified under the Selective Foundry and Forge shop program. This program was started by WMC nine months ago to deal with manpower and production programs. WPB Selective Service and other government agencies concerned are cooperating in this program.

Canadian Iron and Steel Output Gains

Toronto

• • • **Production of iron** and steel in Canada for the month of May showed improvement over the month immediately preceding. Pig iron output at 175,207 net tons was the second highest record in history, being exceeded only by the 175,424 tons reported in October, 1942. For the month under review production was at a rate of 76.2 per cent of rated capacity, while in October, 1942, previous to the installation of three new blast furnaces, production was 99.14 per cent. May production figures compare with 170,364 tons in April, and 154,746 tons in May a year ago. Output included 148,800 tons of basic iron, of which 132,597 tons were for further use of producing companies and 15,203 tons for sale; 11,073 tons of foundry iron and 15,334 tons of malleable iron, all of the latter two grades being for sale.

For the five months ending with May, pig iron output totalled 787,624 tons, which compares with 719,900 tons in the same period of 1943, and 806,039 tons in 1942.

Output of ferroalloys in May amounted to 15,876 tons against 12,818 tons in April and 17,971 tons in May, 1943. Production included ferrosilicon, silicomanganese, ferromanganese, ferrochrome, chrome-x, and ferrophosphorus. For the first five months of the year production amounted to 73,336 tons, compared with 93,642 tons in the same period of 1943 and 93,179 tons for 1942.

Production of steel ingots and castings in May totalled 263,431 net tons which is an average rate of 88.8 per cent, and compares with 260,825 tons made in April and 271,737 tons for May, 1943. Production for the month under review included, 251,463 tons of steel ingots and 11,968 tons of castings. For the five months ending with May output of steel ingots and castings totalled 1,271,833 net tons, against 1,259,652 tons in the corresponding period last year, and 1,305,075 tons in 1942.

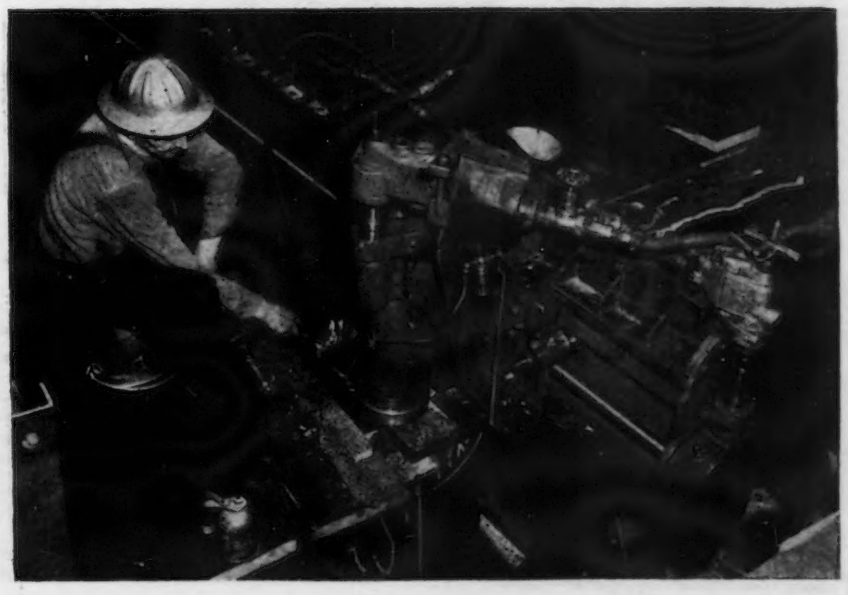
Imports in Canada Show Gain

Ottawa

• • • **For the month** of May imports into Canada were valued at $159,038,000, against $154,393,000 last year. For the first five months this year, imports were valued at $712,050,000, compared with $692,922,000 in the 1943 period. The United States was the leading source of supply when imports from that country for May totalled $127,041,000 against $123,968,000 last year, and for the five month period American imports were valued at $586,727,000 against $567,313,000, according to the Dominion Bureau of Statistics.

Imports of iron and steel and their products for May with comparative figures for May, 1943, in brackets are as follows: Rolling mill products, $4,328,000 ($6,093,000); engines and boilers $5,681,000 ($5,531,000); farm implements $3,704,000 ($1,487,000); machinery other than agricultural $7,560,000 ($13,268,000).

TIME SAVER: *At the Portland yard of the Oregon Shipbuilding Corp., a worker operates this special portable milling machine on a foundation plate going into a Victory ship turbine. Powered by two compressed air motors, the machine, which is operated by two men, can do the work of five men working 8 shifts in half the time.*



Armed Services Concerned Over Drop in Steel Production Attributed to Heat Wave and Manpower Shortages

Washington

• • • **A note of alarm** over the drop in steel production was sounded at a meeting last Friday of the WPB Iron and Steel Industry Advisory Committee by representatives of the Armed Services and the Maritime Commission. The committee was told by these sources of their imperative needs for steel if allied forces in Europe are to be adequately supported. It was conceded that none of their programs had been cut back by reason of steel shortage but fear was expressed that there would be a serious lack of tonnage if the steadily declining production was not halted.

Indicative of the concern shown over the situation, attributed to manpower shortage and hot weather, was the report made at the meeting that 26 plate mills had been placed on the urgency list for top priority in labor referrals and that the inter-agency deferment committee had agreed to the deferment in the steel industry of 500 key men under the age of 26. Discussion on how these individuals will be selected took place between industry and government representatives.

Because of the gravity of the situation WPB, through its production executive committee, also promised to give top priority ratings to steel plants producing various types of vitally needed steel in districts where increased manpower must be obtained. WPB Executive Vice-Chairman Charles E. Wilson, said that it was agreed that the steel companies would initiate local drives at all steel plants in cooperation with WMC representatives to stimulate recruitment.

Also discussed was the extent to which the industry could assist in producing the most vitally needed steel products by transfer of employees from one operation to another. Industry members, however, pointed out that this practice has been followed heretofore to the utmost.

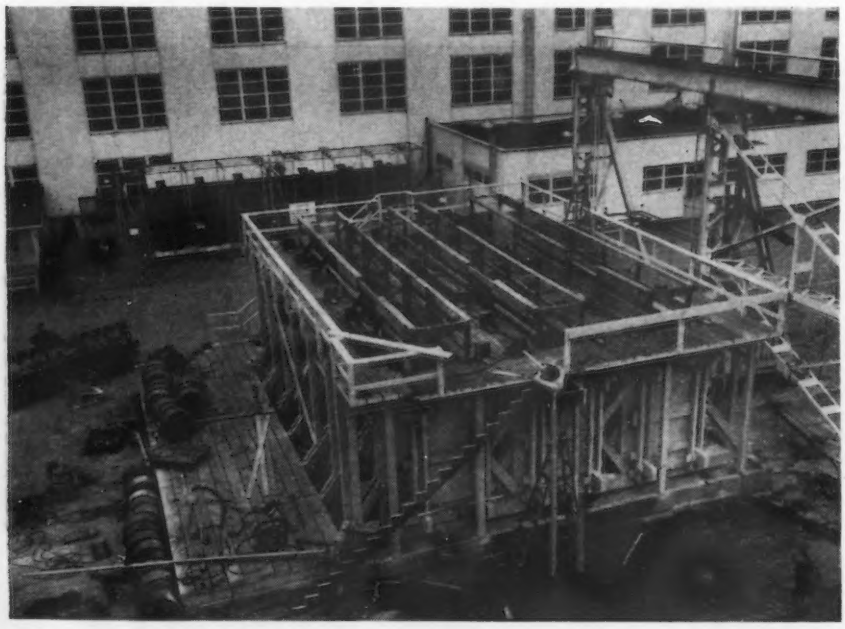
Mr. Foy, government presiding officer at the meeting also explained that the steel division is constantly scheduling production of various finished products in plants best equipped to produce them. He said it was impossible for WPB, after its requirements Committee had made allotments for approved programs, to differentiate between them.

The WPB Steel Division Director placed the loss of production at approximately 500,000 tons a month. Industry members said that the drop in output is due to a manpower deficit of between 40,000 and 50,000 employees. They told of the exhausting burden that has been placed as a consequence on the present labor forces, many of whom work 16-hr. days. In the case of one company, the meeting was told that the total force has been working an average of 57-hr. a week. It was pointed out that with the coming of hot weather, it is physically impossible for the men to continue at this rate, especially in view of the fact that the average age of the steel industry employee has increased materially since the outbreak of the war.

Mr. Foy said that steel production had dropped from 100 per cent of capacity in April to 94.3 last week. Mr. Wilson stated that this drop had occurred when demands of the armed services are probably at their highest point. These requirements include increased emergency demands for heavy artillery ammunition, heavy duty trucks, tanks and naval and merchant vessels.

Mr. Foy said that while WPB had discounted a reduction in third-quarter production of five per cent below that of second quarter output, it had not expected that the lowered percentage of operation for the third quarter would be encountered, as it was, in the first week of July.

PICKLING PROCESS: *This open air installation, consisting of three tanks measuring 40 ft. wide, 33 ft. long and 10 ft. deep, is under construction at the Oregon Shipbuilding Corp.'s Vancouver yard. Up to 100 tons of plate steel and pipe can be cleaned daily in this unit by the pickling process.*



WPB Reconversion Order May Settle Controversy

• • • **Under White House** approval, WPB announced this week the orders implementing the reconversion program about which there has been controversy between the WPB and the joint chiefs of staff.

Manufacturers will be permitted to order machine tools, make relatively simple items from aluminum and magnesium and single working models but the major portion of the reconversion plan involving regional adjustments of production to permit small plants to make non-military items wherever materials and labor is free, will be definitely postponed until Aug. 15.

Alloy Steel Analysis Extras Revised on Four Grades by OPA

Washington

• • • **Effective July 12,** OPA has announced its anticipated amendment to the steel price schedule when it made an adjustment of the analysis extras on four grades of alloy steel. Prices on NE 8600 and 8700 steel were decreased $2 per gross ton, for which the new analysis extras are now $13 and $14 per net ton, respectively. The other two grades were increased $3 per gross ton. These are the AISI 4100 and 3100 steel for which the new analysis extras were fixed at $14 and $17 per net ton respectively.

OPA said that this action will affect steel mills' delivered prices on alloy steel blooms, billets and slabs, hot and cold rolled strip, hot and cold finished bars and mechanical tubing and is expected to stimulate greater use by steel consumers of the affected NE grades. By lowering the ceilings on these grades and increasing the ceilings on AISI 4100 and 3100 grades, OPA said that it expects many buyers now using the latter to change their specifications to these NE grades. The AISI grades are now priced at a level equal to or slightly higher than the NE grades.

OPA pointed out that WPB has been endeavoring to increase the use of the NE grades of alloy steel but had found it difficult to induce consumers to shift from AISI to the NE grades as it meant changing to a higher grade. Increased use of NE steels was said to be desirable in order to conserve ferroalloys, to provide a market for surplus alloy scrap and to reduce the amounts of carbon steel scrap used in the production of alloy steels.

The OPA amendment also made two other changes in the price schedule. One removed from the schedule's coverage the pricing of forged axles and car wheels. These products will be covered by Maximum Price Regulation No. 136—Machines and Parts and Machinery Services. The other adds to the steel schedule the standard adjustable regulations by which OPA may authorize a seller to sell iron and steel products at prices which are in effect after delivery when a request for a change in the applicable maximum price is pending.

Under the amendment maximum chemical analyses extras for the affected basic open hearth grades were established as follows:

	Per 100 lbs.
NE 8600	$0.65
NE 8700	.70
AISI 4100 (Mo .15 to .25)	.70
AISI 3100	.85

On analyses of all other alloy steels for which chemical extras and extras for alloy content are not included in the standard extra list the applicable charge for chemical composition and alloy content is to be calculated from the list of extras for hot rolled alloy steel bars as published and filed by the Carnegie-Illinois Steel Corp. The customary differentials for electric furnace quality and for variations from the standard analyses range will apply to these extras.

Price Regulation Is Revised on Bolts, Nuts, Screws, Rivets by OPA

Washington

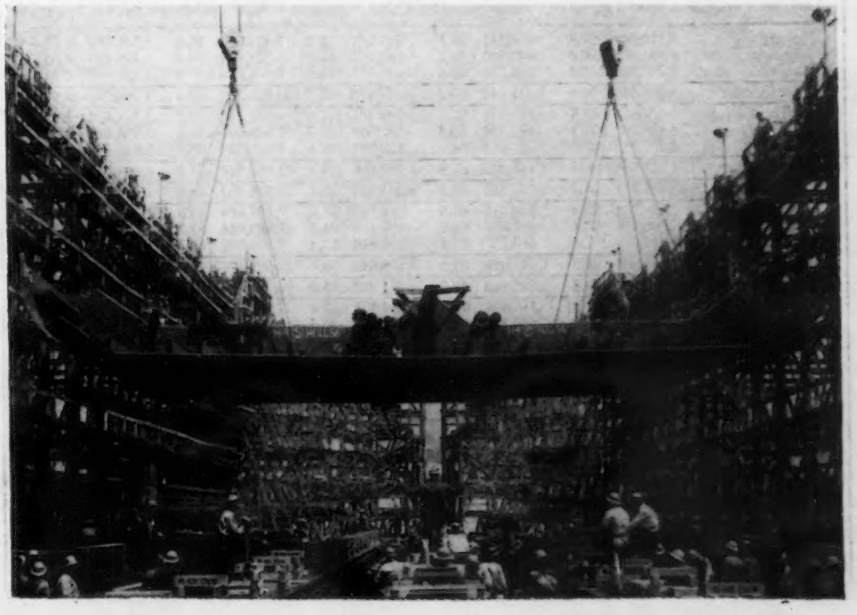
• • • **OPA has announced** a revised price regulation covering bolts, nuts, screws and rivets, which defines more clearly the transactions to which it applies and clarifies its coverage. It takes the place of the original regulation MPR 147 issued in May, 1942, and two amendments. The revised regulation became effective July 12.

The changes are concerned for the most part with clarification of several industry practices not specifically included in the original regulation and with rewording of various provisions for purposes of simplification. A new provision, dealing with producers' minimum charges on small orders, has been added. Other changes deal with orders for small quantities of standard items temporarily not in stock and with the relationship of producers' price schedules to maximum prices.

The revised regulation specifically restores each producer's method of pricing of small orders by permitting him on certain types of sales to use the minimum charge he had in effect and customarily made on the same types of sales between Oct. 1 and 15, 1941, the base pricing period.

The revised regulation provides that on a quantity not exceeding 150 pieces of any item delivered during any seven-day period to any one purchaser the maximum price shall be the maximum price for the item which is cut off, or for an item 2 in. longer than the item ordered, whichever is less, plus the cost of converting the longer item to the item ordered.

LAYING THE KEEL: *The first keel section for the "Hills" type tankers is being dropped into place at the Marinship yard on the shores of San Francisco Bay. As crews set this 76 ton flat bottom and bilge assembly, the program for these* 8250 *hp. tankers got under way recently.*



New York Area Characterized By Peak Production, Full Employment

New York

• • • **The New York region** was characterized last week as one of "peak production, full employment, increased income payments, and highly profitable business" according to a report of the Department of Commerce. All of this despite serious shortages in manpower and materials.

The optimistic tenor of the report was brought about by the fact that New York led all other regions in dollar volume of war supply and facilities contracts. The region, according to the report, accounted for $29,300,000,000 of a total of $189,500,000,000 awarded to the nation from June, 1940, to Jan., 1944.

Of the eleven major industrial districts in the area, northern New Jersey was awarded the greatest share, $9,000,000,000, while New York City ranked next with $5,000,000,000. From a nationwide standpoint these districts were topped only by Detroit and Los Angeles.

While New York City was slow in getting contracts, most of the 30,000 small manufacturing plants are busy with many of them working on war contracts, the report said. A recent study by the Regional Plan Association showed that 1,860,000 persons are employed in manufacturing in the metropolitan area, an increase of 72 per cent over a like period in 1939 and an all time high for the area.

There has been little reconversion in the region since war production dropped from the peak reached last November. Recession from this peak, the report explained, amounted to three per cent and was due to "cancellations, completion of contracts, slow downs necessitated by having to retool for changes in design, and limited manpower."

Ingot Output At 45,061,874 Tons For First Half '44

Production of Open Hearth, Bessemer and Electric Steel Ingots and Steel for Castings

Based on Reports by Companies which made 98.3 Per Cent of the Open Hearth, 100 Per Cent of the Bessemer, and 87.9 Per Cent of the Electric Ingot and Steel for Castings Production. Source: American Iron and Steel Institute.

1944

Period	Open Hearth Net* tons	Open Hearth Percent* of capacity	Bessemer Net* tons	Bessemer Percent* of capacity	Electric Net* tons	Electric Percent* of capacity	Total Net* tons	Total Percent* of capacity	Calculated* weekly production of all companies (Net tons)	Number of weeks in month
January	6,769,438	97.2	439,551	85.4	377,751	83.3	7,586,740	95.6	1,712,582	4.43
February	6,410,338	98.5	409,781	85.2	368,555	87.0	7,188,674	96.9	1,736,395	4.14
March	6,976,450	100.1	455,368	88.5	388,408	85.7	7,820,226	98.5	1,765,288	4.43
1st Quarter	20,156,226	98.6	1,304,700	86.4	1,134,714	85.3	22,595,640	97.0	1,738,126	13.00
April	6,768,895	100.3	437,517	87.8	362,118	82.5	7,568,530	98.5	1,764,226	4.29
May	6,860,532	98.5	438,980	85.3	380,960	84.0	7,680,472	96.8	1,733,741	4.43
June	6,452,087	95.6	418,117	83.9	347,028	79.0	7,217,232	93.9	1,682,338	4.29
2nd Quarter	20,081,514	98.1	1,294,614	85.6	1,090,106	81.9	22,466,234	96.4	1,726,844	13.01
1st 6 months	40,237,740	98.4	2,599,314	86.0	2,224,820	83.6	45,061,874	96.7	1,732,483	26.01

Note—The percentages of capacity operated are calculated on weekly capacities of 1,572,755 net tons open hearth, 116,182 net tons Bessemer and 102,350 net tons electric ingots and steel for castings, total 1,791,287 net tons; based on annual capacities as of Jan. 1, 1944 as follows: Open hearth 82,223,610 net tons, Bessemer 6,074,000 net tons, Electric 5,350,880 net tons.

* Revised January through March, 1944.

1943

Period	Open Hearth Net* tons	Open Hearth Percent* of capacity	Bessemer Net* tons	Bessemer Percent* of capacity	Electric Net* tons	Electric Percent* of capacity	Total Net* tons	Total Percent* of capacity	Calculated* weekly production of all companies (Net tons)	Number of weeks in month
January	6,576,788	97.8	478,161	85.9	369,573	95.5	7,424,522	96.8	1,675,964	4.43
February	6,031,605	99.3	447,810	89.1	345,189	98.8	6,824,604	98.5	1,706,151	4.00
March	6,787,902	100.9	503,565	90.4	383,111	99.0	7,674,578	100.0	1,732,410	4.43
1st Quarter	19,396,295	99.3	1,429,536	88.4	1,097,873	97.7	21,923,704	98.4	1,704,798	12 86
April	6,510,824	99.9	482,478	89.5	380,401	101.5	7,373,703	99.3	1,718,812	4.29
May	6,669,703	99.1	482,424	86.6	397,564	102.7	7,549,691	98.4	1,704,219	4.43
June	6,202,889	95.2	453,663	84.1	382,801	102.1	7,039,353	94.8	1,640,875	4.29
2nd Quarter	19,383,416	98.1	1,418,565	86.8	1,160,766	102.1	21,962,747	97.5	1,688,144	13.01
1st 6 months	38,779,711	98.7	2,848,101	87.6	2,258,639	99.9	43,886,451	98.0	1,696,423	25.87
July	6,556,794	96.8	466,345	90.6	384,737	91.9	7,407,876	96.2	1,675,990	4.42
August	6,700,118	98.7	484,847	94.0	401,499	95.7	7,586,464	98.3	1,712,520	4.43
September	6,646,968	101.4	480,757	96.4	386,614	95.4	7,514,339	100.7	1,755,687	4.28
3rd Quarter	19,903,880	99.0	1,431,949	93.6	1,172,850	94.4	22,508,679	98.4	1,714,294	13.13
9 months	58,683,591	98.8	4,280,050	89.5	3,431,489	98.0	66,395,130	98.1	1,702,439	39.00
October	6,892,029	101.6	513,585	99.5	408,503	97.4	7,814,117	101.2	1,763,909	4.43
November	6,543,204	99.6	440,878	88.2	387,893	95.5	7,371,975	98.6	1,718,409	4.29
December	6,502,980	96.0	390,979	75.9	361,185	86.3	7,255,144	94.2	1,641,435	4.42
4th Quarter	19,938,213	99.1	1,345,442	87.9	1,157,581	93.1	22,441,236	98.0	1,707,857	13.14
2nd 6 months	39,842,093	99.0	2,777,391	90.8	2,330,431	93.7	44,949,915	98.2	1,711,074	26.27
Total	78,621,804	98.9	5,625,492	89.1	4,589,070	96.7	88,836,366	98.1	1,703,804	52.14

Note—The percentages of capacity operated in the first 6 months are calculated on weekly capacities of 1,518,621 net tons open hearth, 125,681 net tons Bessemer and 87,360 net tons electric ingots and steel for castings, total 1,731,662 net tons; based on annual capacities as of January 1, 1943 as follows: Open hearth 79,180,880 net tons, Bessemer 6,553,000 net tons, electric 4,554,980 net tons. Beginning July 1, 1943, the percentages of capacity operated are calculated on weekly capacities of 1,531,789 net tons open hearth, 116,494 net tons Bessemer and 94,667 net tons electric ingots and steel for castings, total 1,742,950 net tons; based on annual capacities as follows: Open hearth 79,867,450 net tons, Bessemer 6,074,000 net tons, Electric 4,935,960 net tons.

* Revised January through December, 1943.

Says President Can Still Tie Wages To Cost-of-Living Index

Washington

• • • **CIO General Counsel** Lee Pressman on Tuesday told the joint panel composed of WLB steel panel and the iron ore panel that the Stabilization Act of Oct. 2, 1942, does not necessarily preclude the President from tying wages to the cost of living index although the WLB has considered the 15 per cent granted under the Little Steel formula as a wage freeze.

Hearings recently completed at Duluth were answered by CIO. Mr. Pressman stated that this was appropriate since steel corporations owned 90 per cent of the ore companies.

Calling attention to a speech made by the President in September, 1942, in which the Chief Executive said that to permit prices to rise without a corresponding increase in wages would be a "sales tax on the workers which we cannot ask them to pay," Mr. Pressman said that even the War Labor Board had expressed concern over growing inequities.

Mr. Pressman said that in one of the Meat-Packing Cases that WLB had asserted that they had received assurance of the economic stabilization director that prices and wages would be stabilized.

The Little Steel formula, Mr. Pressman said, which resulted in a 15 per cent increase to workers, should be adjusted to at least an additional 15 per cent since the retail index has risen this much since the last wage increases were awarded.

Steel Output Sets Record In First Half-Year Despite Obstacles

New York

• • • **New records for** steel production were set during the first six months of 1944 when, despite increasing shortages of manpower, the American steel industry produced 45,061,874 tons of ingots and steel for castings, the American Iron and Steel Institute announced this week.

That total was almost 1,200,000 tons above the 43,886,451 tons produced in the corresponding period of 1943 and exceeded by a narrow margin the previous record output of 44,949,915 tons produced in the second half of last year.

Most of the increase in production came in the early months of this year. In June, output of 7,217,232 tons, equivalent to 1,682,338 tons per week, represented the lowest weekly average in six months.

In May, steel production totaled 7,680,472 tons, or an average of 1,733,741 tons per week. In June, 1943 a total of 7,039,353 tons was made, or 1,640,875 tons per week.

During June, the steel industry operated at an average of 93.9 per cent of capacity, which compares with 96.8 per cent in May and 94.8 per cent in June a year ago. Operations during the first half of this year averaged 96.7 per cent of capacity, as against 98.0 per cent in the corresponding 1943 period.

Officials Meet to Aid Shell Program

Pittsburgh

• • • **War Department** officials and representatives of prime and sub contractors on the recently inaugurated and expanded 8 in. shell contracts met here on July 10 to delve into the tricks and difficulties of getting this program into production. Maj. Gen. Levin H. Campbell, Jr., chief of ordnance; Brig. Gen. R. E. Hardy, chief of the ammunition branch; Col. S. R. Stribling, chief of heavy artillery ammunitions section, and Maj. Thomas J. Moore, Jr., came from Washington to meet with these manufacturers' representatives.

The meeting followed a tour of inspection of the Jones & Laughlin Steel Corp., McKeesport plant, where production on the M-103 and M-106 type 8-in. shells is rapidly getting underway. J and L was the first among some 20 firms that got into production on this size shell and will probably hold the largest 8-in. shell contract.

The J and L McKeesport plant is not operating at capacity on this job yet because there remains much to be done in coordinating operations, smoothing out production details, and completing the installation of manufacturing and finishing equipment. Furthermore, the manpower (of which a considerable part is womanpower) is not thoroughly familiar with production details and an extensive training program is underway. The Washinton delegation of course was concerned mainly with expediting the production of this heavy artillery shell, and the trip throughout the plant was designed mainly with acquainting other manufacturers with what J and L has been doing.

Meanwhile, one section of the plant is still engaged in production of the 105 mm. shells under an old contract. This contract is expected to be completed in the next five or six months, and then much of the available help will be switched over on the heavier shell lines.

Steel Industry Payrolls Reported at New Peak in May

New York

• • • **Steel industry payrolls** and average weekly earnings of wage earners climbed to a new peak in May, according to a report recently released by the American Iron and Steel Institute.

A total of $145,427,000 in payrolls was distributed during the month, as against $138,860,000 in April and $137,404,000 in May, 1943. The previous record monthly payroll was $145,285,000 in March of this year.

Wage-earning employees received an average of 118.4c. per hr. in May and worked an average of 47.5 hr. per week, indicating average weekly earnings of $56.25.

By comparison, in April steel wage earners received 119.0c. per hr. and worked 45.9 hr. per week—indicating average weekly earnings of $54.60 per worker. The previous peak for weekly wages was March, 1944, when average earnings of 115.9c. per hr. and a 47.7 hr. work-week indicated average earnings of $55.30 per week.

In May a year ago, steel industry wage employees earned an average of 113.4c. per hr. and worked 41.9 hr. per week.

During May, 1944, the industry employed an average of 569,000 employees, compared with 573,000 in April. In May, 1943, a total of 632,000 employees was at work.

Subs Get a Favor

Washington

• • • **Subcontractors engaged in war production will enjoy a new privilege in the settlement of terminated contracts it was announced by the War Department this week. The new "Contract Settlement Act of 1944," effective July 21, extends to subcontractors the same right formerly given only to prime contractors who enjoyed a 60-day limitation on the time they were required to store termination inventories.**

This step toward uniformity in the relations between the government and all war contractors was taken after the *Contractors Guide* was prepared and issued by the War Department to help war contractors in the settlement of terminated contracts.

Describing the new 60-day clause provided in the "Contract Settlement Act of 1944," as a method to clear plants speedily of excess property resulting from a contract termination, the War Department explained that the government has a period of two months, from the time the contractor submits his inventory list, in which to remove this property from the contractor's plant.

This time limit serves to expedite the action of both the contractor and the government in making a concerted effort to plow back into war production excess property stored at the contractor's plant.

There's Always a Way

• • • **Unable to attend** ceremonies held at the Sheffield Corp. here when Brig. Gen. H. F. Safford was presented with a Precisionaire gage as an instrument typical of those used in Army gun barrel production, a newspaper reporter got hold of a sound transcription that had been made of the general's speech, played it over and had his story complete.

Early Pittsburgh Program Will Contribute Toward Shell Production

Pittsburgh

• • • **A program, put** into effect during the defense period prior to Pearl Harbor by the officers of the Pittsburgh Ordnance District is expected to contribute materially toward success in the production of large artillery shell for the Army.

In 1940, at the request of the Ordnance District, F. C. Biggert, Jr., chairman of the board of United Engineering and Fdy. Co., started development of an hydraulic billet piercing press, which is said to have shown unprecedented speed in production and economies in manpower.

Three have been in operation for making six-inch shell—two at National Tube Co., McKeesport, and one at Tennessee Coal, Iron and Railroad Co., Alabama. In addition, five of the same size—400 tons—are on order, two for Bethlehem Steel Corp., one for Tennessee Coal, Iron and Railroad Co., one for Oldsmobile division of General Motors and one for United Engineering.

United Engineering also is building a similar press of 800 ton size for eight-inch shell for itself and has one of those on order for Kentucky Shell Co., Newport, Ky. Further, it is designing one of 1200 tons to produce 240 mm. shell for Bethlehem.

Not only is the company producing presses for others, but it also has an Army Ordnance contract to forge and machine six-inch and eight-inch shell at New Castle, Pa. This contract, including installation of equipment and cost of shell, will aggregate a total sum of between $25,000,000 and $30,000,000.

The United press consists of a machine which has four punches on a rotating turret. The four stations are loading, piercing, unloading and cooling. This arrangement is economical of punches and with handling equipment to permit high speed operation has resulted in an average production of 200 six-inch shells per hour, or roughly twice as many as has been produced on any other type of shell piercing press.

The billet is centered in a holder at the loading station and the piercing is accomplished by lowering the die over the billet and thus forcing it over the stationary punch. Following the piercing, the shell are elongated over a mandrel in an hydraulic roller draw bench operation. They are then ready for machining.

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Buffalo

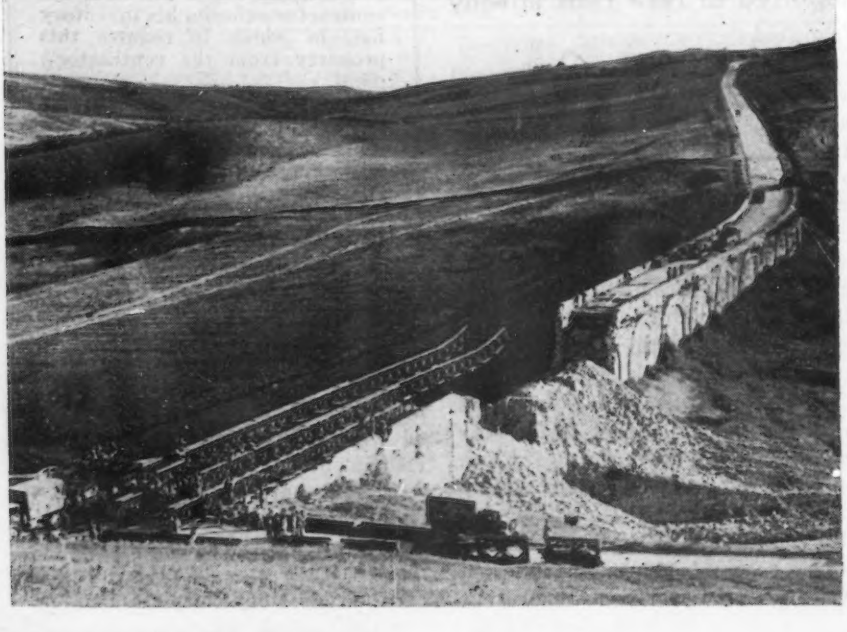
• • • **The vast majority** of workers at the American Car & Fdry. Co.'s Buffalo shell plant according to Ordnance officials, have done an excellent job in producing large caliber shells in enormous quantities since the earliest days of the war. But there was one bad spot that troubled management and that was in the continued absenteeism on the part of a few workers. Absenteeism was averaging nine per cent, an enormous and needless waste in total production.

Morris S. Evans, district manager of the plant, who tries to salvage every excess pound of steel while producing in quantity shells that fully meet the rigid requirements of Army and Navy Ordnance, was convinced that the average worker would respond to proper persuasion and that this problem of absenteeism could be licked. He talked the matter over with Frederick A. Stevenson, president, who personally supervises all production in a.c.f. plants, and received his help and counsel in formulating a plan which has now been in operation for about three months. The result is a reduction in absenteeism at the shell plant by about 10 per cent to 12 per cent; or from nine per cent to eight per cent of total employment.

The first step was the placing of a plywood sign measuring 6 x 9 in. on every machine in the production line. The sign reads, "This Board For Attendance Declaration," and in further explanation, "On this board will be placed a card which you are asked to check and sign signifying whether you will help our fighting men by being on the job tomorrow or whether you will hold up supplies for the front by being away from your job. The card will be collected an hour before the close of the shift. YOUR COUNTRY NEEDS YOUR HELP!" Cards are distributed at each of the three shifts.

The pledge which each worker is asked to sign each day reproduces the National Emblem and underneath the legend: "Realizing the urgent need by our government, for the large caliber shell which we are making, I indicate below whether I will be at my work (day designated) and on time." The cards are picked up one hour before the shift closes and those set aside where the worker has indicated he will not be at his station the following day. He is then visited by his foreman who attempts to persuade him to be on the job. Those who have promised to do so and who do not appear have their cards returned to them the following day with the legend stamped thereon "Broken Promise" and the worker is asked to appear before the Board which sits twice daily.

THE BAILEY BRIDGE: *Royal Engineers erect a Bailey bridge somewhere in Italy. The best answer yet to enemy demolitions, the Bailey bridge has great strength and stability. Its interchangeable parts can be speedily put together.*



Industry Fights for Existence During Iron Ore Wage Case Hearing

Cleveland

• • • **The outstanding impression** gathered from the hearings of the iron ore industry wage case in Duluth was that of an industry with its back to the wall fighting for its existence. Presentation of the industry's case was done so thoroughly that more than one union had cause to wonder whether compliance with union demands was what was actually wanted.

While the union demands numbered 23, one less than in the steel industry, the hearing was centered on 13 so-called monetary demands affecting the price ceiling on ore. Ten other demands of non-monetary nature were held back for later consideration and bargaining, as in the case of the steel demands. The industry flatly rejected all 13 demands and presented individual briefs discussing the hardships imposed by each.

When some union members came to realize that the excessive costs arising out of the demands might jeopardize the very existence of many underground mines and possibly seriously affect the employment of as much as 77 per cent of the miners, some doubt as to the desirability of attaining the stated goals was reported.

At the last minute, the union also rung in seven additional demands originating from the locals. The industry felt that this action was unfair in that the hearing had been set specifically to answer 13 stated demands of the national union and these added demands had never been known before. It was also confusing in that the local demands are believed to conflict or overlap in some degree with the original, national demands.

The additional demands in brief were: An increased reporting pay, a pay-check stub showing both hours worked and rate, an undefined pension retirement plan, more free time for grievance committeemen, an undefined promotion plan, additional mine car transportation and a complete new set of safety and health rules.

The first statement for the industry was made by Earl E. Hunner, representative of the M. A. Hanna Co. He refuted the idea that there were nothing but captive mines producing iron ore for steel companies. He quoted OPA figures showing that in 1942 total tonnage of merchant ore shipped was approximately 22,552,580 tons or roughly 25 per cent of all the iron ore shipped. He pointed out that granting the demands would seriously prejudice the competitive position of Lake Superior underground mines which employ the greatest amount of labor and already have the highest labor and production costs.

Mr. Clarence J. Hartley, attorney for the Oliver Iron Mining Co., emphasized that while production between 1940 and 1943 increased 38.8 per cent, the number of employees increased 49.8 per cent. The total man-hours increased 68.5 per cent and total payroll increased 117.3 per cent. These figures were to show the substantial increase in the man hours per ton for producing ore.

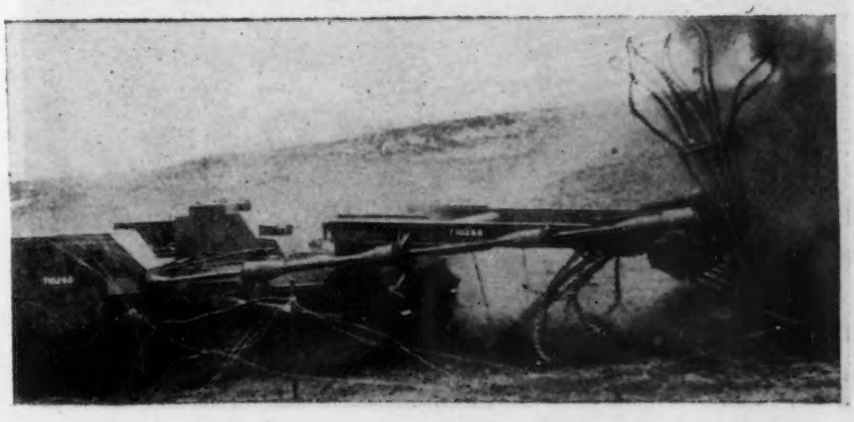
Harry A. Applequist, representing the Interstate Iron Co., declared the imposition of a shift premium upon the iron mining industry would be nothing more than a device for a general wage increase contrary to the wage stabilization program.

Mr. Hartley also brought out that more than one-half of the employees are engaged in mining underground ore, although only 18 million of a total of 84 million tons mined in 1943 was produced by this half of the ore industry's employees. "Separate consideration should be given to the cases of the iron mining companies upon the basis of conditions of the industry," Mr. Hartley said.

Alexander C. Brown, vice-president of the Cleveland-Cliffs Iron Mining Co., said that underground mines employ 57 per cent of the miners in the region and that they have production costs per ton of ore that are four times greater than open pit mines. He said the consequences of increased costs would seriously disrupt the commercial and cost relationship between the various types of mines. The beneficiating pits, Mr. Brown said, employ about three times as many per ton and consequently have tripled the labor costs of the direct shipping pits. Beneficiating pits represent about 20 per cent of the industry's total employment. The combination of the underground mines and the beneficiating pits represents about 77 per cent of the employees of the industry. The ratio shows 77 per cent of the employees produced only 42 per cent of the ore, while the open pit mines, employing only 23 per cent of the total, produced 58 per cent of the shipments. Mr. Brown said that economic progress will force some of the high cost mines out of business, even under normal conditions. He emphasized that any further increases in labor costs with their disproportionate application to each of the classes of mines, will augment such consequences for the large majority of the mines and their employees. A recent survey for OPA, Mr. Brown said, shows that underground mines cannot sustain any increased labor costs under present OPA ceilings and that necessary increases in price cannot be collected by underground mines under any normal conditions.

Based on 1943 tonnage figures, Mr. Brown said that if the cost of indicated union demands for the underground mines had been in effect they would have increased production costs from $1.51 per ton to $1.98 per ton. This is compared with an estimated average value of ore at the mine of $2.60 per ton.

MINE REMOVER: *This British "flail" tank, operating in the Normandy battlefields, consists of a tank chassis fitted with a special anti-mine device which projects whirling chains which scoop out and explode mines in its path.*



Believe Wave of Outlaw Strikes Will Cause Postponement of Victory

BY D. C. MAC DONALD
Cleveland Regional Editor

Canton, Ohio

• • • **Observation of current labor** strife leads to the belief on the part of some observers that the unions' no-strike pledge is proving valueless; that a wave of unauthorized flash strikes is beginning; that the unions are now rushing to consolidate all possible gains before V-day and that V-day itself may be postponed as a result if these tactics are permitted. A notable example of the pettiness of current strikes and also their far-reaching implications is set by the recent all-out strike at the Timken Roller Bearing Co. here.

Timken is an outstanding example of labor's persecution of a vital industry. The strike which ended recently was the company's 47th since Pearl Harbor. Probably at least a half million manhours have been lost in that period. With two strikes in June, the company reports a manhour loss for the month of 230,040 hr. and at least 6000 tons of alloy ingots, but most important is a loss in production of at least 500,000 tapered roller bearings. Timken represents about 20 to 25 per cent of the entire bearing industry but produces about 90 per cent of the tapered roller bearings. These are critical components for nearly every piece of mechanical equipment used by all branches of the armed forces.

Shady implications of the purpose of strike-haltering at the plant have been cast about, which the union, of course, denies and speaks of holding "its patriotism close to its breast."

Despite cries of patriotic fervor from the union, the fact remains that bearing production is being impeded at a critical time to serve the ambitions of the union and its leaders. The union does not openly sanction strikes at Timken or elsewhere but accomplishes the same effect by permitting departmental squabbles to cause walk-outs. Rather than calling a strike the union times meetings so that they fall a few minutes before the beginning of a shift. In order to attend the meeting the workers miss an entire shift. Continuous meetings, held on a three shift basis, create the same effect as a strike yet remain legal. Hence, despite vigorous protestations of a no-strike pledge, strike results are being obtained.

The latest demand of the USWA at Canton on the Timken Co. is for a permanent government arbitrator, the union claiming that relations with the company have broken entirely. The company is unable to comprehend this demand for an arbitrator since most grievances of the union are never submitted by them to the arbitration procedure which was supplied in their contract and at the union's request. This provides the services of the American Arbitration Association, said to be a most reputable organization.

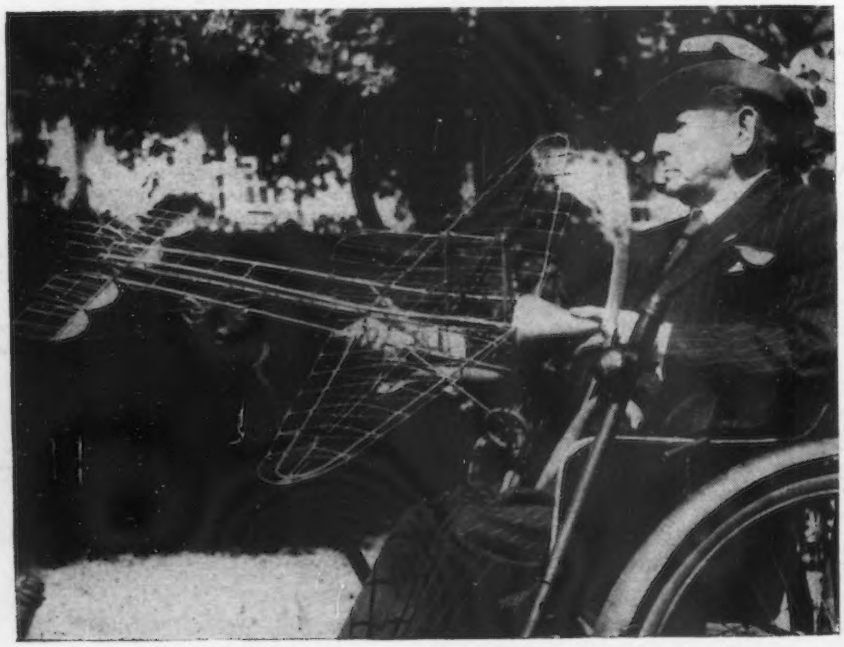
A good bit of opinion expressed around Canton indicates that the union favors a government arbitrator because of expected leniency, while others say that the long strike record of Timken has been deliberately planned in an effort to get the government to take the plant over from the present management. The union is said to have flatly announced in meetings that it is going to get its demands regardless and the no-strike pledge and the urgency of bearing production will have to suffer for the growing pains of the union.

A more sincere analysis of the problem discounts most of these rumors and opinions and charges the condition of affairs to the ambitions of the CIO director and the union's determination to consolidate all possible gains before V-day or such time as severe cut-backs remove the bargaining club of top urgency production needs.

The patriotic appeal of the invasion, the long casualty lists, the urgency of certain military production programs which the unions are advised about by the military; the critical need for certain components and every other factor which should influence unions to put personal gain aside in deference to the war effort, are having no influence now. A new wave of strikes is looked for by some in order that the unions can get everything they can.

The possibility that V-day might be postponed by strikes must be considered in view of union activities at present. Huge stockpiles of many military items cannot be built up due to frequent changes and improvement. Also the rate of expenditure of materiel has increased sharply and will continue to do so on the Continent and in the Pacific. Unions that are banking on enough materiel having been produced to warrant a letdown now for personal gain are overlooking a grave danger that the vital components may not be available when a crisis arises.

"SECRET WEAPON": *In England, 84-year-old Frank Bozon, inventor, examines a model of pilotless plane he invented 34 years ago. It was designed to take a torpedo suspended underneath. Bozon brought out the old invention to show that the Nazi "secret weapon" was old stuff to him.*



Increase in Number and Severity Of Strikes Cut Deep into Steel Output

Pittsburgh

• • • **Strong efforts by** the WPB Iron and Steel Division and the steel industry as a whole to overcome the effects of hot weather and manpower shortages on steel production have, in the past few weeks, been knocked into a cocked hat by irresponsible and sporadic outlaw strikes. Not only have these quickies been increasing in number recently, but the serious nature of the work stoppages has become more pronounced.

Aside from the mere cold statistics on the number of ingot tons lost by these strikes is the unheralded but, nevertheless, serious effect upon intricate steel scheduling, steel delivery, and product mix. Practically all work stoppages, recently, have had as their focal point a strike of a disgruntled few whose place in the chain of the steel production cycle is so important that other processing beyond that point has been stopped cold. It is somewhat like dominoes, which, when all are stood upright in a straight line, a general tap on the leading one knocks down the whole pile.

Even further is the fact that steel companies are having more difficulty today in arranging their steel scheduling to adequately meet the needs of the armed forces, so that any work stoppage which interferes with the inventory of or the flow of the correct steel analyses, completely jams up the schedules even after the strike has been settled.

Somewhat of a condition occurred recently when 30 cranemen in the Carnegie-Illinois Steel Corp.'s DPC Homestead Works, under the guise of a wage disagreement, got tired working and struck. This stoppage forced the complete shutdown of 10 open hearths at the Homestead Works, and finally caused an irreparable loss of more than 18,000 tons of steel ingots. This figure tells little until it is recalled that the Homestead Plant makes plates and structurals. Plate and structural backlogs are already heavy and carryovers are mounting daily, in some cases, representing more than a half month's production. A strike such as the one mentioned not only keeps the company from making any headway on its carryover, but has the depressing effect of increasing the carryover to such an extent that WPB officials and steel production men almost literally tear their hair out by the handfuls. In this particular case, by shutting down the structural mills, the Homestead plant was able to stock slabs in order to maintain operations on the plate mill.

Not only is the company which has the strike affected, but, eventually, other steel companies are drawn into the picture because they are forced to take on additional tonnages in an effort to meet the total flat rolled directives. This latter action is necessary, because, usually, the company whose plants are struck has already been working at the maximum rate of capacity, before the losses occur. Thus, no tonnage can be made up.

Another recent strike, which in some quarters is dismissed as just another work stoppage, will have serious repercussions for months to come. A wheel and axle plant in this district has been subject to shutdowns over the past two or three weeks. Rollers, producing wheels, were off for 12 days recently, causing a loss in production of one of the tightest items in the railroad car building industry. Subsequent to the strike in the wheel department, was the shutdown in the axle plant. Again, axles are probably the second tightest item in the railroad repair and car building picture. Two or three months hence, car builders, who through miraculous persuasion have garnered together bars, plates and structurals, to make sorely needed freight cars, will be yelling their lungs out for wheels and axles and they may not be there.

In conjunction with the WPB, the Steel Industry Advisory Committee has made it plain that the manpower shortage and strikes have made it impossible for the steel industry to utilize its full capacity. It has been further indicated that if the manpower had been available for the past several months, and if the work stoppages had not been so extensive, the huge plate and sheet carryovers today would probably not be of such magnitude. As long as these two factors continue to remain in the picture, it seems obvious that the WPB Requirements Committee, in its fine attempt to properly distribute available steel, will be continually harassed and upset to an extent where some consumers will be unable to get the steel they were promised, when they were promised.

Union experts, industrial relations men, "analysts," crystal-gazers, and government officials, have looked for the basic reasons for the work stoppages. Many have bedammed and bemoaned, and many have come up with different and various reasons.

BOOBY TRAP ROCKET: ***Wary Yanks examine but do not touch a multi-barreled Nazi rocket gun in the invasion sector of northern France. Sign on the abandoned weapon warns of possible booby traps.***

The best cross-section, or rather composite, opinion here seems to indicate a combination of long working hours, long weeks, European war successes, time-consuming WLB hearings, and a general but spontaneous feeling of, "oh, what the hell."

Union leaders here, although not speaking for quotation, have been extremely worried over their loss of control in preventing outlaw strikes and in getting the men back again. Some industrial experts are of the opinion that these strikes are a basic pattern, to force action by the WLB on the wage question. Just as many other observers doubt this and point to the continued irritableness of the rank and file workers over the past several months. Some quarters think that this "trigger action," which has resulted in an increased number of strikes may eventually be basic material for much more serious walkouts if the WLB decision on steel wages does not satisfy the rank and file.

•

Chicago

• • • **Because union members** at the John Deere Harvester Co., East Moline, Ill., struck during a dispute over the company's vacation plan, the Sixth Regional War Labor Board has denied the union's request for a more liberal plan.

Citing the increased length work week since the present plan was inaugurated, the UAW-CIO had requested that employees eligible for one week's vacation receive 48 hr. pay instead of 40, and those eligible for two weeks' vacation receive 96 hr. pay instead of 80.

The board's majority opinion stated: "On May 20, a strike occurred which lasted for several days. While this strike was not directed against the board in an attempt to force this particular vacation issue, it was a direct result of a dispute with the company over the vacation plan. Board members are of the opinion that granting of any further liberalization of the vacation plan in this case (even if it were justified on its merits) might lead to the provocation of similar strikes in other plants of the Deere company. Other local unions, having surrendered their claim for the more liberal vacation plan, are undoubtedly watching the outcome of this case. If it should become evident that the one or two locals which chose to strike over the company's vacation policy were to be the ones to be rewarded, other locals would be tempted to go and do likewise.

"This is no time to create the impression that unions violating the no-strike pledge will be rewarded for such conduct. This board has been set up to aid those unions and employers which observe the 'no strike, no-lockout pledge' and not to place the stamp of approval upon those which violate the pledge with impunity. If the board should establish a policy of rewarding the recalcitrant, it might justifiably be charged with destroying that which it has been created to maintain peaceful industrial relations."

LEND-LEASE: *Planes are delivered to an American air base by American ferry pilots, then turned over to the Russian fliers who take them into the Soviet Union. Here, a P-39 Airacobra, is delivered to the Russians. Note the belly tank arrangement that provides sufficient gasoline for the longer legs of the journey. The Russians particularly like the Airacobra because of its firepower, especially the 37 mm. gun in the nose that is quite effective against tanks and armored cars.*

Young Resigns from WPB

Washington

• • • **The War Production Board** announced the resignation of Howard I. Young, deputy vice chairman for Metals and Minerals, effective July 1.

Mr. Young is returning to St. Louis to devote full time to the affairs of the American Zinc, Lead and Smelting Company, of which he is president. He came to Washington early in 1943 to assist in coordinating the minerals and metals program of the War Production Board.

McComb Appointed Director

Washington

• • • **Arthur J. McComb,** Montclair, N. J., has been appointed as director of the WPB Office of Industry Advisory Committees, effective July 15. Mr. McComb will succeed John C. Whitridge, Darien, Conn., who has resigned after one and a half years with WPB to return to the International Business Machines Corp. Mr. McComb is vice-president of the Otis Elevator Co.

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Signs of Decreasing War Production Are Evident in Cleveland

Cleveland

• • • **First traces of** decreasing war production are believed showing up in this city. In the opinion of a large number of industrialists and government men, the pressure on producers is easing somewhat, but this is highly controversial and is shunned by the WPB.

First major indication came when nearly 100 war plants took advantage of the July 4 holiday to shut down for the week. By those who care to draw this interpretation, this means that work has caught up somewhat and the intense pressure of the past three years is off. The WPB, interested in industrial morale, scoffs at this reasoning. Not all other government men do, however.

A second indication of decreasing production pressure on some types of products is found in a quickening trend with some plants to lay off men when any contract hitch occurs. Two prominent plants here are known to be having some contract difficulties which have occasioned small layoffs. This has had little consequence except to indicate that the men could not be absorbed by other departments and managers are no longer disposed to maintain a padding of extra manpower. Part of this is explained by the clarification of draft rulings which places some men in a reasonably certain spot in the eyes of employers.

Being a subcontracting center, Cleveland has felt some effect from the tendency of prime contractors to pull subcontracts into their own shops as soon as possible. This is believed the cause behind some of the present contract difficulties. The desire to hold men on the job as padding has originated in the past mainly from the expectation of new orders to come. The fact that men are now beginning to be laid off indicates slimmer hopes for new war contracts, observers believe.

The WPB opposes this interpretation and has been quick to defend the plants which are taking a week-long holiday here. The WPB describes the move as "good sense" and emphasizes the fact that both men and machines have had a very difficult and strenuous three to four years which has brought both near to the point of exhaustion.

While the delay in production is not too well accepted by WPB, it believes

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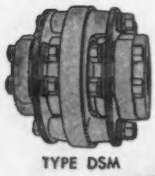
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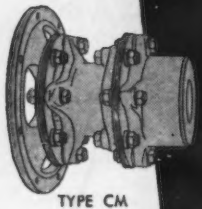
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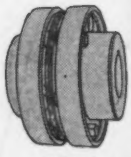
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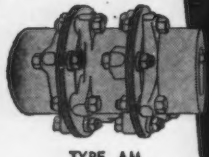
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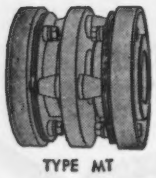
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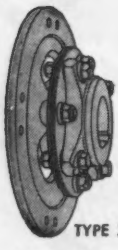
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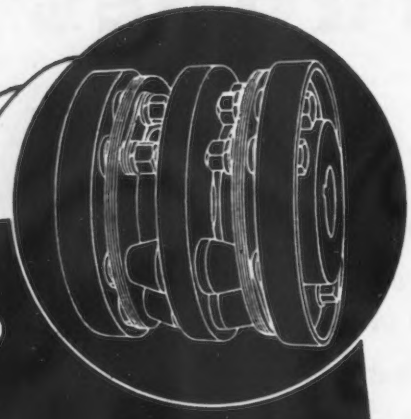

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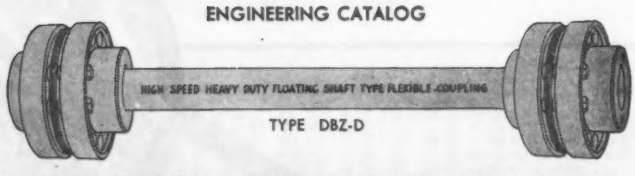

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THOMAS FLEXIBLE COUPLING CO.
WARREN, PENNSYLVANIA

that use of the week for maintenance of machinery and refreshment of workers will pay dividends later.

It was emphasized that excellent forethought was shown by industry in selecting a holiday week for the shutdown as absenteeism might have gone to 25 or 30 per cent anyway. It is admitted that from the maintenance standpoint the week's delay may be well worthwhile. On the other hand, since a week's vacation is due most workers it was thought wise to utilize the holiday week when a minimum of production could be expected under any conditions.

On the issue of declining production pressure, WPB admitted that a good many plants were in better condition than at anytime during the war mainly because of more careful scheduling and improved worker efficiency. However, no sweeping statement in this direction could be made, as this area is and will be loaded with top urgency orders involving the heavy artillery and other big programs for a number of months. The decline in a number of other programs would do little more than grant the leeway necessary to get these programs out on time, this authority said.

New Engineer Text Offered

New York

• • • **Written to meet** the needs of a young engineer training for design, "Materials and Processes," edited by James F. Young and published by John Wiley & Sons, Inc., presents in one volume a broad study of materials and manufacturing problems employed by the design engineer. This textbook, organized for convenient reference as well as for classroom presentation, considers chiefly the materials and processes used in manufacturing electromechanical products. Materials and processes used only in building construction are not considered. Sufficient metallurgy is included to understand heat treating practice and the effects of various processes on metallic materials. In the discussion of processes, enough detail for understanding the basic nature of each process is given. Included in the discussion on processes are casting, powder metallurgy, hot and cold working, welding, machining and finishing.

Many of the chapters have been written from lectures given in a general course in materials and processes conducted in the advanced engineering program of the General Electric Co. The book contains 628 pages and sells for $5.

The CONE AUTOMATIC MACHINE COMPANY sees today GOOD THINGS AHEAD

It is reported that:

The world's most powerful electric motor has recently been completed. Developing 7,000 horsepower at only 25 r.p.m., it is said to be capable of lifting an entire four stack destroyer at the rate of 200 feet per minute.

get ready with CONE for tomorrow

A new resin dip for small metal parts feels like rubber, protects the part, strips easily by hand and may be re-used.

get ready with CONE for tomorrow

A new invention consists of a panel that hangs over a bed and is a source of radiant energy. Properly adjusted to the sleeper's metabolism and length of slumber, it is expected to give him the equivalent of a full night's sleep in as little as two hours.

get ready with CONE for tomorrow

The rare metal, indium, is being used as a tarnish-proof plating for gold and silver and is being used as an alloy in bearing metal and solder.

get ready with CONE for tomorrow

A new chemical does most of the work of the dangerous hydrofluoric acid without danger to the human skin.

get ready with CONE for tomorrow

The new plastic-coated fabrics will be water-proof and abrasion-resistant and may be flexed for a long time before cracking. They will be useful materials for baby carriages, auto tops, furniture, bus seats, shoe tips, raincoats, luggage, shower curtains and handbags.

get ready with CONE for tomorrow

Even the high-pressure cylinders used to hold compressed gases are now being made by stamping and drawing.

get ready with CONE for tomorrow

A colored surface .0001 inch thick, applied to the surfaces of gages does not affect their accuracy, but warns of wear by a change in color.

A national producer's council hopes to reduce the cost of home building by 20% by promoting more modern building codes and labor regulations.

get ready with CONE for tomorrow

The by-products of sawdust have become so valuable that some sawmills are using coal for fuel.

get ready with CONE for tomorrow

A prominent scientist states that it may take twenty years to utilize fully the scientific discoveries made since Pearl Harbor.

get ready with CONE for tomorrow

A synthetic shellac made from corn is expected to permanently replace the natural product which is made from the secretions of an insect found in India.

A large manufacturer of farm machinery proposes to enter the peace-time farm market with a line of refrigerators and cold storage lockers.

get ready with CONE for tomorrow

A new low-temperature grease permits aerial cameras to operate at temperatures as low as 100 degrees below zero.

get ready with CONE for tomorrow

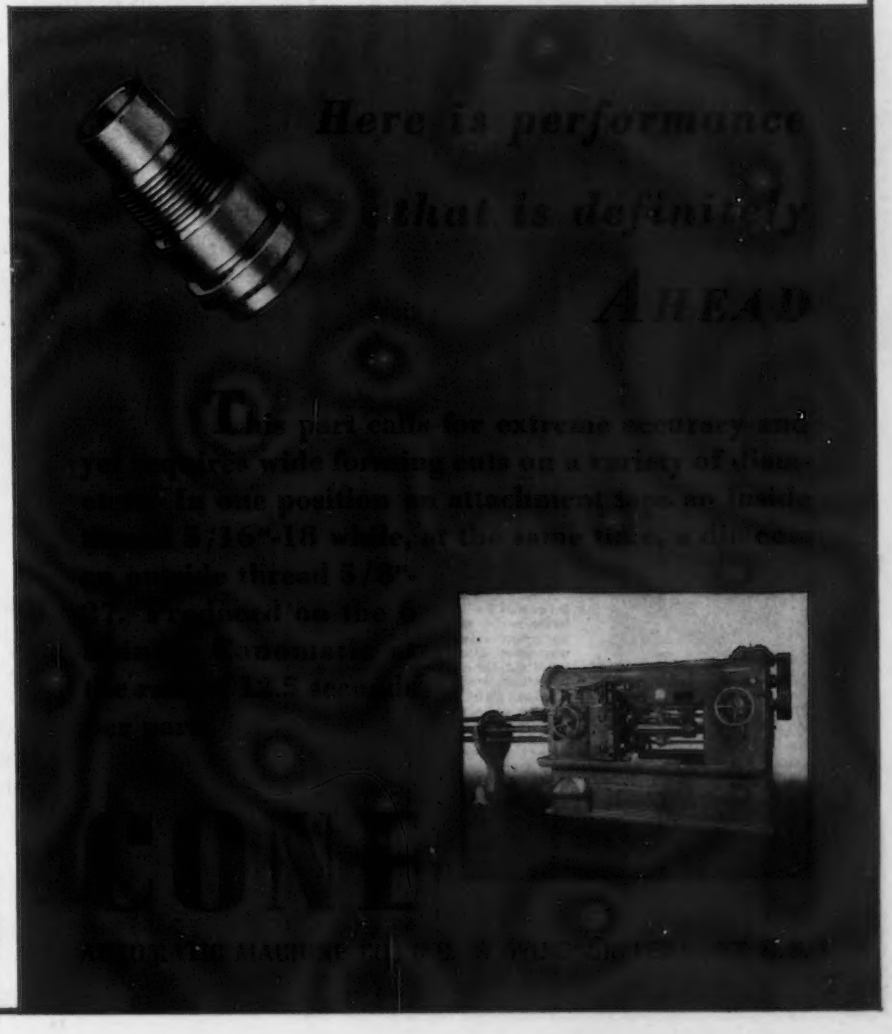
A French automobile manufacturer expects to make a small, economical car for the American post-war market.

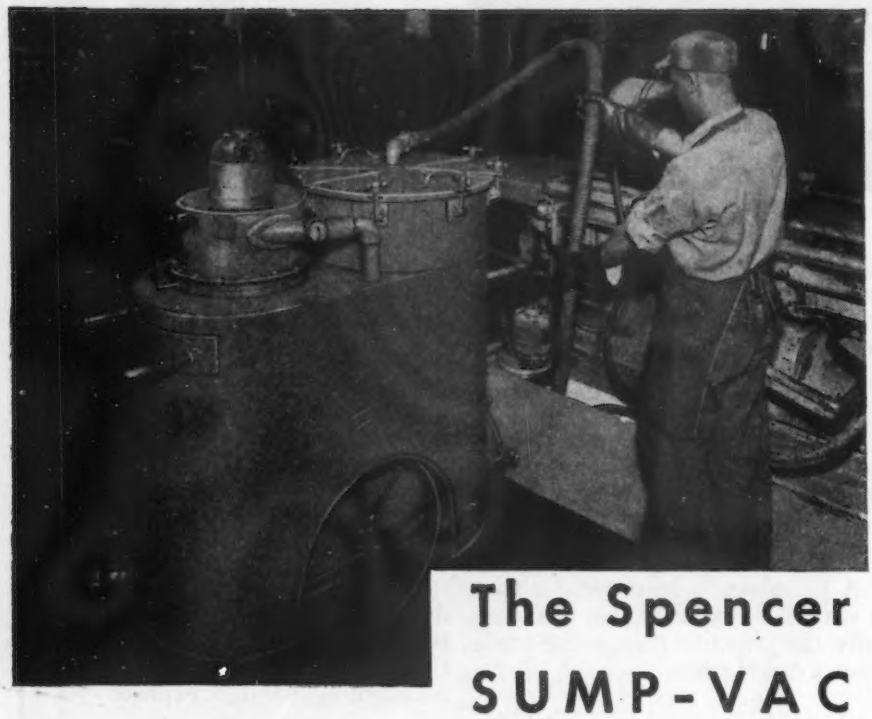
get ready with CONE for tomorrow

A maker of paper parachutes, for dropping supplies to troops, expects to continue their manufacture after the war for use in the air delivery of mail and light-weight express.

get ready with CONE for tomorrow

The world's shortest firing range, only twenty-two feet long, duplicates the air pressure and temperature of the stratosphere.





The Spencer SUMP-VAC

Cleans Sumps in 2 to 10 Minutes

A Spencer vacuum producer mounted on a closed tank on wheels removes all liquid and sludge from sump tanks in two to ten minutes compared with half an hour with former methods. The rate of pick up is 40 gallons of liquid per minute.

The tank capacity is 125 gallons or enough for 3 to 5 average sumps. A filter basket collects chips and heavy sludge. A Neoprene float valve prevents overfilling of the machine. It is emptied by gravity in two minutes. By turning the valves provided with the machine and connecting the hose to the drain valve, liquid can be discharged under approximately 3 lbs. pressure. This permits raising the liquid to a height of 6 ft., emptying the tank into a drum or other container for easy disposal. No priming is necessary—and all material in the sump tank is cleaned out by air vacuum after the liquid is removed.

Sizes ¾ or 1½ horsepower, universal or single phase motors, 25 to 60 cycles, 110 or 220 volts or d.c.; 12½ foot vacuum hose lengths and 50 foot cable extension. Ask for the bulletin.

Pick-up position: Suction hose on intake at swivel connection—Two way valve open—slide valve in — three way valve open to atmosphere.
Discharge positio
Pressure in tank—hos
on drain valve — tw
way valve closed—slide
valve out closing intake
to vacuum producer and
opening ports to allow
air to be drawn into
vacuum producer from
outside—three way valve
closed delivering air
into tank under pressure.

SPENCER HARTFORD VACUUM CLEANING

THE SPENCER TURBINE COMPANY, HARTFORD 6, CONN.

16

Control of Aircraft Plant Returned to Alien

• • • **James E. Markham,** Alien Property Custodian, recently issued a Divesting Order, returning the controlling interest in the Luscombe Airplane Corp., producers of Navy training planes and naval aircraft parts, to Leopold H. P. Klotz, of Trenton, N. J. and of New York, whose management brought the company to a leading position in the light aircraft field.

L. H. KLOTZ

Mr. Klotz, described by the government as a friendly alien, had applied for United States Citizenship some years before the war.

Leo T. Crowley, then Alien Property Custodian, had replaced Mr. Klotz's management with that of Matthew J. Hickey, Jr., of Chicago, as chairman of the board, and Lee N. Brutus, of Troy, Ohio, as president and general manager of the company's plants at Trenton and its ground schools at Dallas, Texas and at Trenton. Both Mr. Hickey and Mr. Brutus have not been connected with the company for some time.

Since his temporary severance from Luscombe Mr. Klotz has been associated with Winslow, Douglas and McEvoy, New York investment bankers.

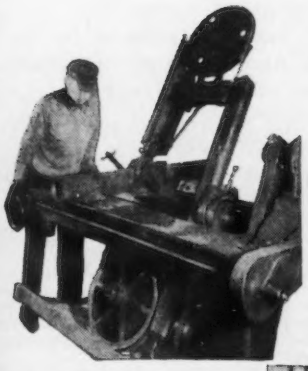
Jones & Laughlin Acquires Steel Barrel Subsidiary

Pittsburgh

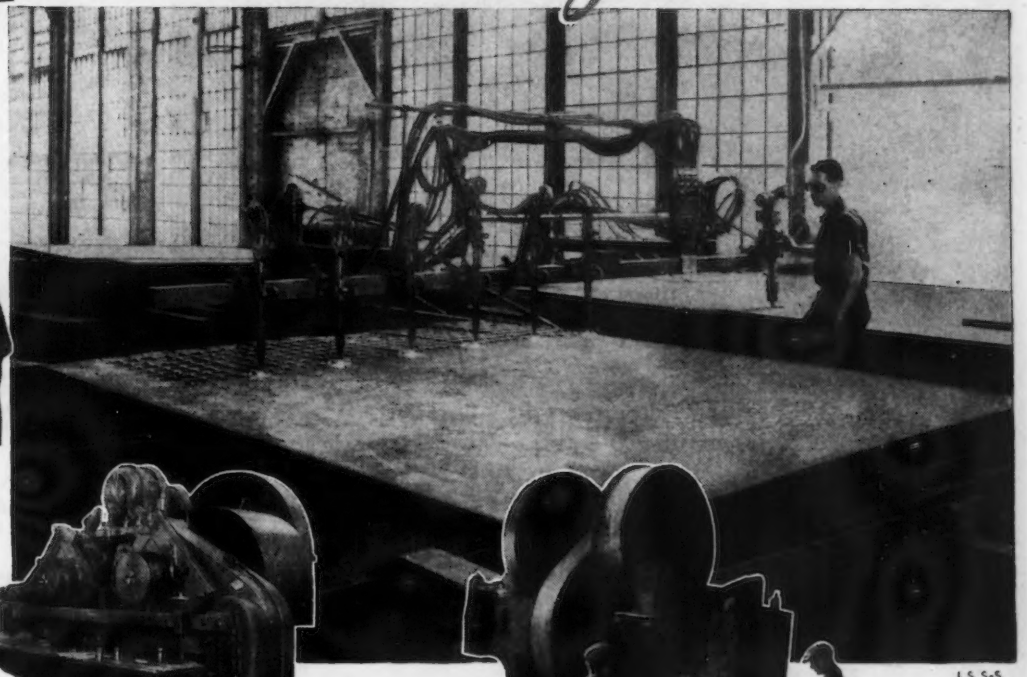
• • • **Jones & Laughlin Steel** Corp. announced that its subsidiary, J. & L. Steel Barrel Co., has purchased the physical assets and business of the Draper Mfg. Co., Cleveland.

Draper is the oldest manufacturer of steel barrels in the United States and many of the improvements made in steel barrel construction have been developed by this company over the years.

The Draper division of the J & L Steel Barrel Co. will be operated under the present managing personnel. With the acquisition of the Draper facilities, the J & L Steel Barrel Co. will more advantageously serve its customers.



A look-in on our Modern Cutting Operations



LS S-5

LEVINSON STEEL

GOOD WAREHOUSING service is vitally dependent upon diversified cutting equipment. At Levinson you will find the most modern Planographs, Multigraphs, Do-Alls, Plate and Angle Shears, and so on. But all these would be worthless to the buyer of steel unless we backed them up with speed in operations, accuracy in meeting specifications, and good old-fashioned courtesy and co-operation in our dealings with our customers. ¶ For it is all of these factors that form the background of dependable Levinson service!

LEVINSON STEEL SALES CO.

33 Pride Street · Pittsburgh, Pa.

It Takes the Best
TO MAKE THE BEST

Heat Treated Steel Shells

FOR THE heat treatment of heavy artillery, R-S Engineers have developed an automatic gas-fired installation of standard design which consists of a hardening furnace, quench unit and convection type draw furnace. The shells are pushed through the hardening furnace in parallel conyeying tubes, are quenched internally and externally, then leave the quench tank on a conveyor and go through the draw furnace on alloy chains.

Here is continuous operation that typifies not only the excellence of R-S Furnaces but the versatile, painstaking abilityof R-S Engineers.

FURNACE DIVISION
R-S PRODUCTS CORPORATION
4524 Germantown Avenue, Philadelphia 44, Penna.

R-S QUALITY PRODUCTS SINCE 1908

R-S Furnaces of Distinction

ANNEALING CONVECTION ROTARY HEARTH SALT BATH FORGING
CONTINUOUS CONVEYOR PLATE AND ANGLE HEATING METAL MELTING CAR HEARTH

★ ★ BUY WAR BONDS ★ ★

NAM Offers Contract Termination Program

New York

• • • **A six-point plan** to expedite the settlement of terminated war contracts has been released by the National Association of Manufacturers' Advisory Group on war contract termination.

The plan urged:

1. **Termination control centers:** Today 85 per cent of the dollar value of all war contracts flow through a few hundred major war contracting centers. In so far as possible these should be converted to control centers for termination purposes.
2. **Direct settlement of subcontracts:** If suitable releases between buyers and sellers can be arranged without destroying contract identifications, a by-pass would be provided for direct settlement with the subcontractors by the procurement agency.
3. **Settlement teams:** Banded units of accounting, disposal, legal and technical officers would be stationed at the control centers as required. The Baruch-Hancock Report recognizes this necessity.
4. **Designated settlement agencies:** "Contract center" companies would be assigned to a Designated Settlement Agency which would conduct negotiations, certify claims, authorize payments and perform other related functions.
5. **Contractor settlement of limited subcontract claims:** Prime contractors and qualifying subcontractors would be authorized to settle nuisance, small or simple claims and thus eliminate unnecessary red tape, expense and delays.
6. **Grouping of individual claims for single negotiation:** This would permit grouping of properly identified individual contract claims for purposes of renegotiation but would be restricted to situations where grouping is a short cut in paper work, an elimination of duplication and a reduction of negotiation and settlement time, agreed to by both the settlement parties.

GOING NOWHERE: *Railroad tracks curl grotesquely into the air as a result of Allied bomb hits at Carentan, France. Yanks entering the town found much evidence of the efficiency of their bombardiers in smashing Nazi lines and communications.*

NICKEL AIDS THE COMMUNICATIONS INDUSTRY

to KEEP 'EM IN TOUCH!

In the tradition of Morse and Bell and Marconi, the communications engineer carries on today.

His work, always valuable, now is vital.

No military campaign proceeds without it. The close teamwork between air, ground, and sea arms is possible only through instruments and equipment that keep them in touch though scattered throughout the four quarters of the globe.

And the vastly increased pace of modern war production brings with it increased use of every home-front circuit, line and wave-length.

All branches of the communications industry... telephone, telegraph, radio ...are *meeting* the tremendous demand for their products. In war, communication engineers are taking advantage of their long peacetime experience with metals and alloys.

Time and time again this experience has shown them that a little Nickel goes a long way in improving other metals.

So now, when the dependability of what this industry makes is of supreme importance to the Nation, it favors more than ever the use of Nickel.

In repeaters, relays, magnetos, loading coils, transformers, loud-speakers and modern cables... even in the molds that form plastic radio parts... they call upon Nickel and its alloys for several unique advantages.

When other metals lack toughness, Nickel often supplies it. When they lack strength and fatigue resistance or corrode too easily, adding Nickel provides the needed qualities. Under abrasion, wear, shock and stress metals perform better *with* Nickel than *without*.

In the communications industry, as in many another, the knowledge, experience and cooperation of our staff has been at the disposal of technical men. Whatever *your* industry may be... if you want help in the selection, fabrication, and heat treatment of alloys... similar counsel and data are at your service.

Catalog "C"

makes it easy for you to get Nickel literature. It gives you capsule synopses of booklets and bulletins on a wide variety of subjects — from industrial applications to metallurgical data and working instructions. Why not send for your copy of Catalog C today?

* Nickel *

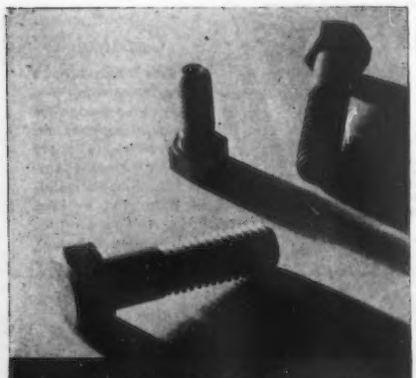
THE INTERNATIONAL NICKEL COMPANY, INC., *67 Wall St., New York 5, N. Y.*

OLIVER

CAP SCREWS

Made to close tolerances, closely checked by "Quality Control" inspections, Oliver Cap Screws are true to dimensions, cleanly threaded and of uniform strength. Because we know that cap screws generally have particularly exacting jobs to perform, we take especial pride in making them to fully meet your toughest assignments.

The experience gained in the design and manufacture of other Oliver products—bolts, nuts, rivets, upset items—is utilized in making cap screws that give complete satisfaction always. We will be glad to discuss your cap screw requirements with you.



For uniformly high quality cap screws, specify Oliver!

OLIVER
IRON AND STEEL
Corporation
PITTSBURGH, PENNSYLVANIA
BOLTS . . . NUTS . . . RIVETS
STEEL FASTENERS

ARBA Says Highway Construction Must Be Doubled After the War

Washington

• • • **Even though the war were to last through 1945, there would probably be 38,000,000 motor vehicles of all types in operation by 1950, or ten per cent more than the previous high, according to studies of the American Road Builders' Association.**

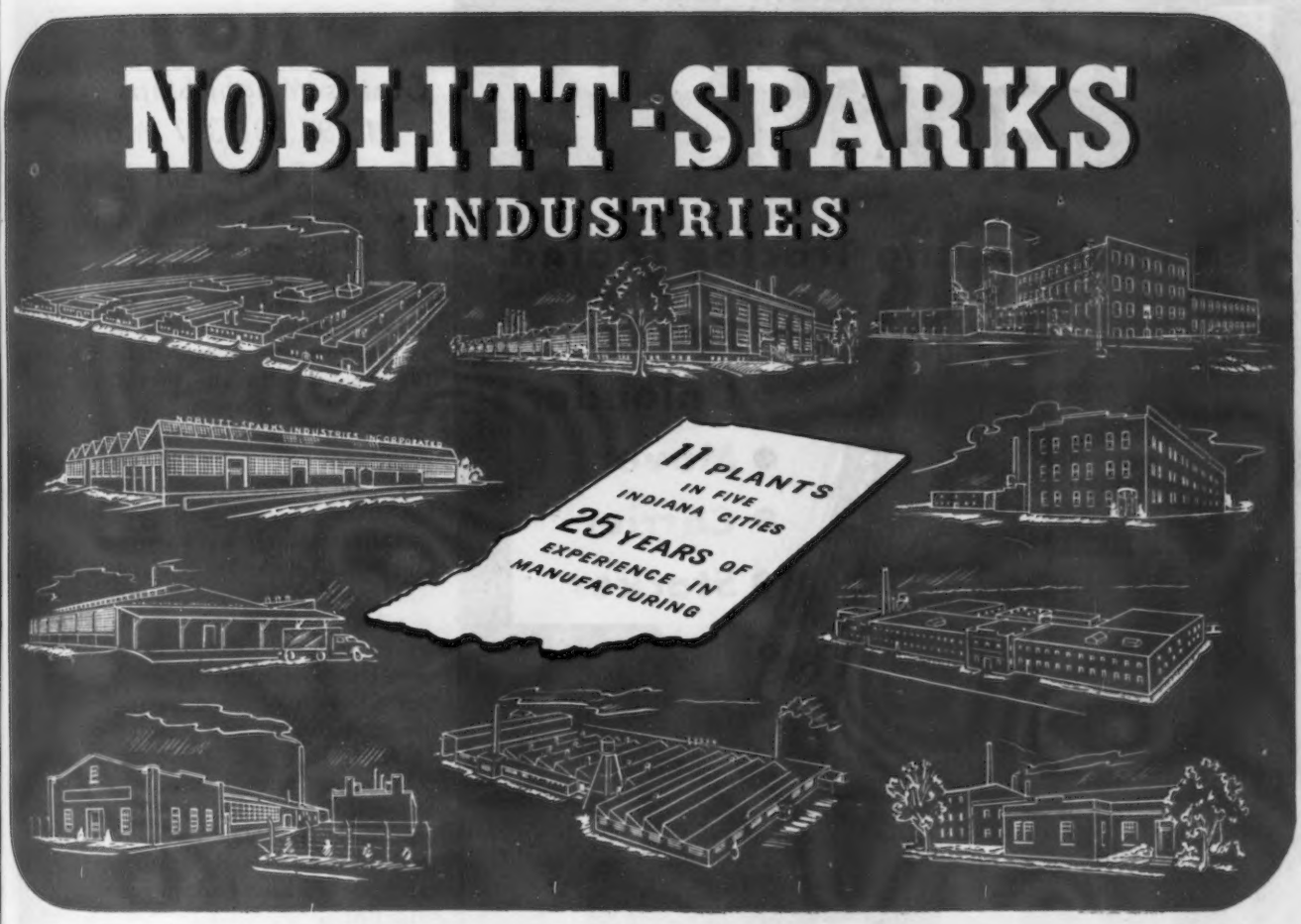
To meet the increased traffic demands produced by the higher registrations, and more intensive use of vehicles, and to reduce motor accidents which reached alarming proportions in the last prewar year, road and street construction must be doubled after the war. That belief is held generally by safety and highway authorities, according to Charles M. Upham, engineer-director of the association.

"At the end of 1943, 30,500,000 vehicles were in use, records of the Public Roads Administration show," according to Mr. Upham. "Since car production stopped in February, 1942, the loss in registrations was approximately four million vehicles. By the end of 1944 there will be only 28,500,000 vehicles of all types.

"If the war continues through 1945 and no new cars are manufactured, the nation will be down to 26,500,000 motor vehicles which is as many as were in use at the peak of the prosperous '20's. Calculations are based on scrapping approximately two million cars per year.

"In the first year after the war, because of conversion delays, manufacturers probably will be able to do little more than replace the scrapped cars for that year. But from then on there should be a rapid increase in production. Regaining the 1941 production rate would make a registration of 38 million cars by 1950 entirely possible. Manufacturers have stated they will exceed prewar production. The one thing that can hold car sales down will be the lack of adequate roads and streets.

"Doubling highway construction will constitute an ideal means of providing jobs when and where they will be needed after the war. Authoritative estimates indicate a surplus of workers of nine million or more over the expected requirements of industry, government and the armed forces. Planned public works construction serving urgent public needs is the one means of avoiding the spending of billions for relief work," concluded Mr. Upham.



You Can Depend On Us For

Fabricated Metal Tubing

OR TUBING AND STAMPING ASSEMBLIES

Because of our years of experience in volume production of metal tubing and stampings, we may have the exact facilities and the "know how" to fabricate what you need, to your advantage.

Noblitt-Sparks makes and forms metal tubing into any shape—welds it to other parts stamped from metal—assembles, plates or paints the entire unit—ready to go into your product. We've been doing that for many manufacturers—for 25 years—companies who have depended on us for many different kinds of assemblies. Perhaps we can help you, now or later—with engineering assistance, as well as production. If you have a specific job in mind, write or call . . .

Harlow Faulke

Vice-President and Director of Manufacturer's Parts Division

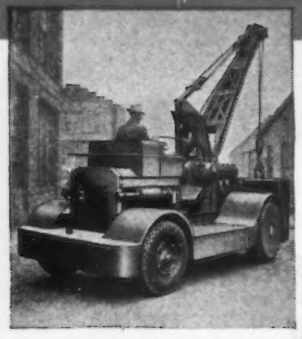
NOBLITT-SPARKS INDUSTRIES, INC. • COLUMBUS, INDIANA

ROUSTABOUT CRANE

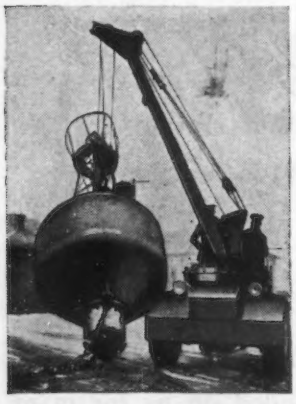
The Free-Roving Tractor Footed

- **Loader**
- **Unloader**
- **Mover**
- **Carrier**
- **Stacker**

• MC-4 Roustabout Crane – long handling range, fast travel with load, easy steering. Ball-bearing, running-in-oil construction.



Rear view MC-4 Roustabout Crane



MC-4 totes easily an ocean-going buoy

For Fast, Efficient Low-Cost Load Handling You Need the MC-4

IT KEEPS THINGS to 7½ tons moving around your plant, airport, railroad, dock. . . . It's where you need it when you want it, tireless, easy to run, low in operating cost. . . . It pays for itself quickly in saved time, manpower and expense. . . . Modernly engineered and built for years of overwork. . . . Hundreds of users say they wouldn't be without their Roustabout Cranes, keep them in daily profitable use. . . . It pays you to write for the whole story — today, now.

THE HUGHES-KEENAN COMPANY
571 NEWMAN STREET • MANSFIELD, OHIO

ROUSTABOUT CRANE

Roustabout Cranes
By Hughes-Keenan
Load-Handling Specialists Since 1904

Curtiss-Wright Ships $1,295,236,317 Worth Of Equipment in 1943

• • • **Curtiss-Wright** Corp. shipments of aircraft, engines and propellers during 1943 totaled $1,295,236,317, an increase of 68.1 per cent over 1942, G. W. Vaughan, president, anounced as the company prepared to file its 1943 report with the Securities and Exchange Commission.

Curtiss-Wright shipments for this period not only were the largest of any of the nation's aircraft companies, but mark the first time that any of the aircraft firms has exceeded a billion dollar volume for one year's shipments and represents approximately 15 per cent of the industry's total dollar output for the year according to estimates obtained from the Aeronautical Chamber of Commerce. This figuse compares with 1942 shipments of $770,594,882.

Shipments have been almost wholly to the United States Air Services and lend-lease, Mr. Vaughan stated. Curtiss C-46 *Commando* transports are carrying a major portion of supplies into China, maintaining the "Aerial Burma Road," and Curtiss SB2C *Helldiver* dive-bombers are playing an increasingly important role in Pacific naval action. The Curtiss P-40 *Warhawk* fighter is continuing to do vital combat duty on many fighting fronts, particularly in the China-Burma-India area.

Wright Cyclone engines are powering most of the famous bombers, including Boeing's new B-29 *Superfortresses* which recently bombed Japan, the Boeing B-17 *Flying Fortress*, the North American B-25 *Mitchell*, Douglas A-20 *Havoc* and SBD *Dauntless*, Curtiss *Helldiver*, Martin PBM *Mariner*, Grumman TBF *Avenger*. Wright Cyclones also are used in the Martin *Mars* and the new Lockheed C-69 *Constellation* transport.

Extends Production Date

Washington

• • • **The date by** which the 500,000 enameled cold pack canners scheduled for production in 1944 may be completed has been extended from July 1 to October 1, 1944, the WPB reports.

This has been affected through amendment of Direction 1 to Limitation Order L-30-b, issued July 1, 1944. No other change has been made in the provisions governing the production of enameled cold pack canners.

Diamonds WERE NEVER MORE PRECIOUS

Reports from Germany and Japan tell us that in those countries gem diamonds are being removed from valuable jewelry and converted to industrial uses—such is the scarcity of industrial diamonds.

This is readily believable for diamonds have never been more precious than today when they serve so many purposes in vital war production. In 1943, American industry used about nine and a half million carats of industrial diamonds and will use still more in 1944. Without these diamonds, war production never could have reached its present levels.

The particular contribution of Wheel Trueing Tool Company is in building industrial diamonds into fine quality diamond tools, engineered to do a superlatively good job in truing and dressing grinding wheels for straight, form or thread grinding, diamond boring or turning tools, contact gage points and diamond bits for drilling and mining operations.

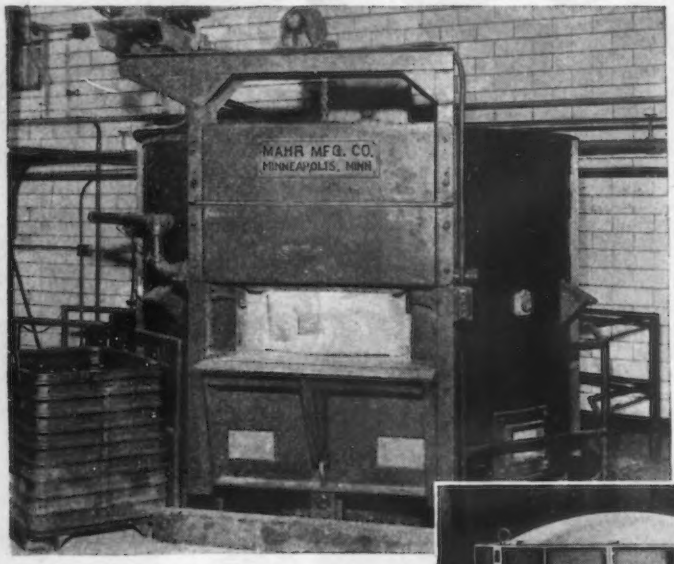
These tools have established an unexcelled record of performance in stepping up production, saving time and cutting costs, a record due in no small degree to the fact that they are backed by a third of a century of research and manufacturing experience.

WHEEL TRUEING TOOL COMPANY

3200 W. Davison Avenue
Detroit 6 • Michigan

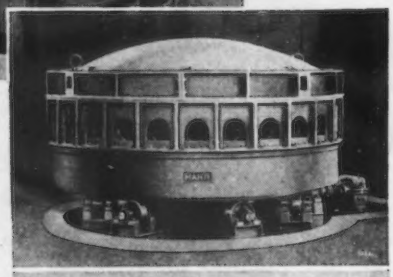
575 Langlois Avenue
Windsor, Ont. • Canada

STARTLING REDUCTIONS
in decarb and oxidation of forging billets



(LEFT) MAHR Center Fired Rotary Hearth Furnace. One of a battery of these furnaces in the very modern forging plant of a large midwestern manufacturer.

(BELOW) MAHR Rotary Nosing Furnace used for heating the nose of high explosive shells. Continuous, high production is characteristic of this center fired rotary. In this furnace, however, the entire furnace rotates.



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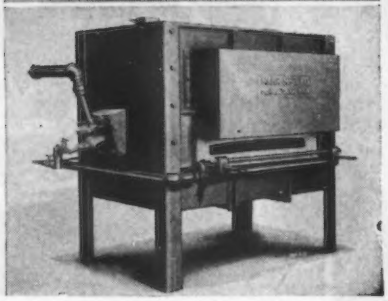
MAHR

ENGINEERS • DESIGNERS • MANUFACTURERS
ALL EQUIPMENT FOR METAL HEATING

Center Fired
ROTARY HEARTH FURNACE



A modern MAHR Slot Type Stationary Forging Furnace. Fires toward and with arch from both sides. Illustrated and described in Bulletin No. 210.

As in other MAHR furnaces, the method of firing is the fundamental reason for the outstanding success of this furnace. Only one burner is used, therefore burner adjustment is simplified. This powerfully efficient burner fires upward directly toward the arch. The flame wipes the arch and the hot gases flow downward over the entire hearth area giving remarkable uniformity.

And here's the most important point—because of this method of firing, the fuel has time for *thorough combustion* before the hot gases reach the stock. Combustion has rendered all harmful gases practically harmless before they could reach the stock. Thus, decarb and oxidation have been nearly eliminated. One extensive user states decarb and oxidation are reduced by from 65% to 75% over other methods of heating.

Ask for Bulletin No. 1000 giving complete details about MAHR *center fired* Rotary Hearth Furnaces, or Bulletin No. 210 about other MAHR Forging Furnaces.

CAR BOTTOM, CONTINUOUS, BATCH, POT, BELL TYPES—DIRECT FIRED OR RECIRCULATING—OIL, GAS, OR ELECTRIC—A FURNACE FOR EVERY HEAT TREATING OPERATION—TORCHES, RIVET HEATERS, BURNERS, BLOWERS, FANS, VALVES. ASK FOR BULLETINS.

MAHR MANUFACTURING CO.
DIVISION OF DIAMOND IRON WORKS, INC.
1721 NORTH 2nd ST. MINNEAPOLIS 11, MINN.

German Armor Found Not Consistently Good

Washington

• • • **The Germans are** finding it increasingly difficult to cope with the constantly mounting firepower of American guns and howitzers. This information comes from metal experts of the Ordnance Department, Army Service Forces, who subject the latest captured enemy equipment to a series of scientific metallurgical tests.

A memorandum from Lt. Col. G. L. Cox, chief of the Ordnance Department's cannon section, reveals that welded German armor is not consistently good.

The Germans consider their guns a most vital product and spare no effort to keep them good. Their armor is made from good steel and is well treated, but with the alloying elements available to them, the Germans must necessarily go to higher carbon to achieve depth of hardening. This works a tremendous hardship upon the weldability of armor.

In general, German armor seems to have higher hardness which gives it a brittleness, making it less resistent to the impact of large projectiles.

The Germans spare no effort to find ways to defeat these pile-driving projectiles, including such emergency engineering as extra plates hung loosely on the vehicle or extra tank treads spread strategically on the front or sides of tanks. These are all admission of the tremendous striking power of American weapons.

WPB Permits 15% Increase In Steel for Garment Hangers

Washington

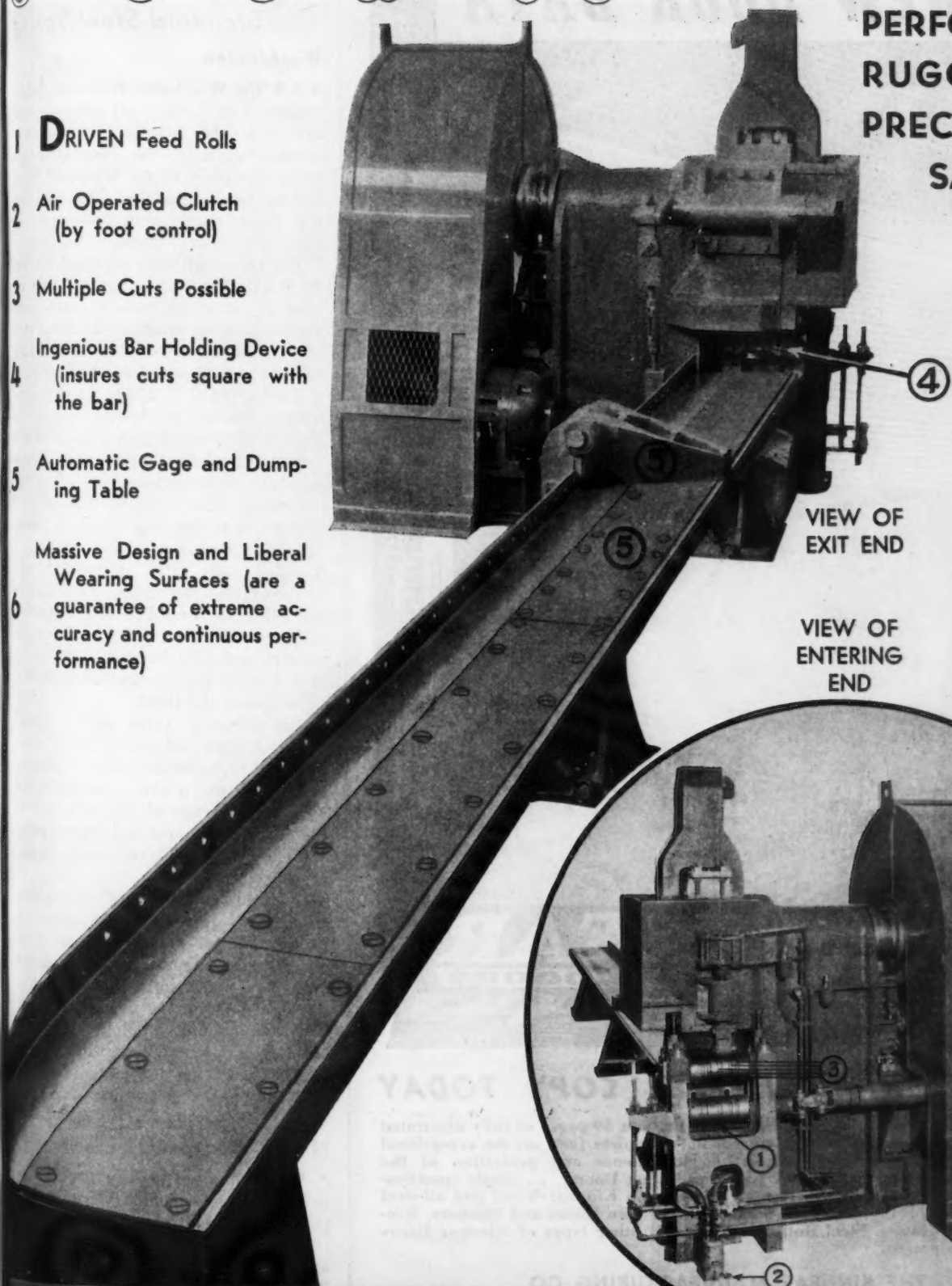
• • • **WPB has upped** by 15 per cent the amount of steel that can be used in the second quarter for the production of garment hangers. Under Direction 2 to L-3-d, WPB last week authorized each manufacturer to use 35 per cent of the average quarterly amount of steel he used in the year ended June 30, 1941. Further liberalizing its policy, WPB also allowed the use of steel wire to any gage obtained from any source. Previously, WPB permitted the use of only wire shorts or rejects and certain gages of wire and wire obtained from distressed stocks or included in a manufacturer's inventory on June 17, 1943.

The increased use of steel for hanger manufacture in the second quarter is in addition to the quantity consumed in the production for military purposes as well as any unused part of the first quarter quota.

McKAY Bar Shear

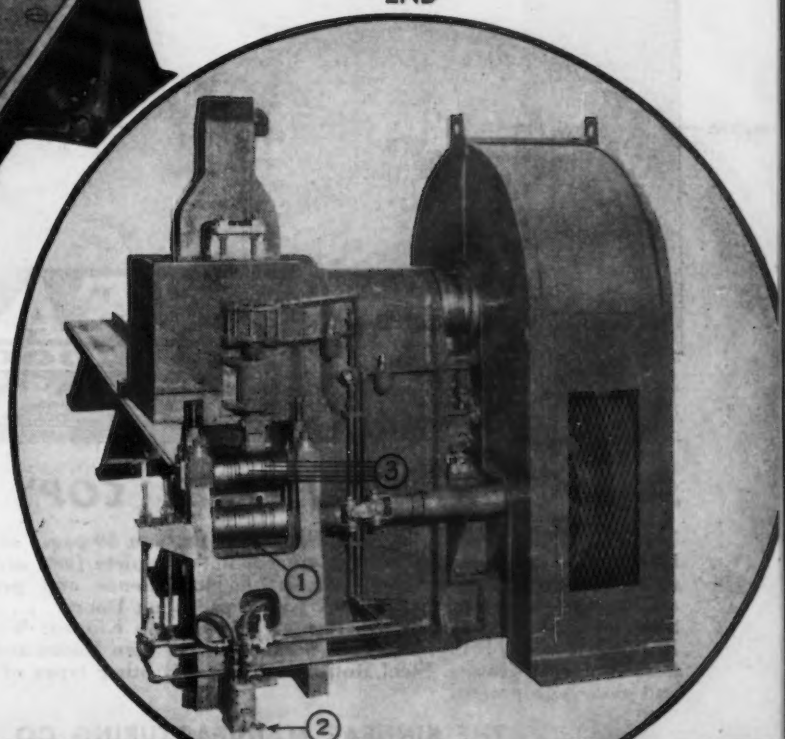
PERFORMANCE
RUGGEDNESS
PRECISION and
SAFETY

1. DRIVEN Feed Rolls
2. Air Operated Clutch (by foot control)
3. Multiple Cuts Possible
4. Ingenious Bar Holding Device (insures cuts square with the bar)
5. Automatic Gage and Dumping Table
6. Massive Design and Liberal Wearing Surfaces (are a guarantee of extreme accuracy and continuous performance)

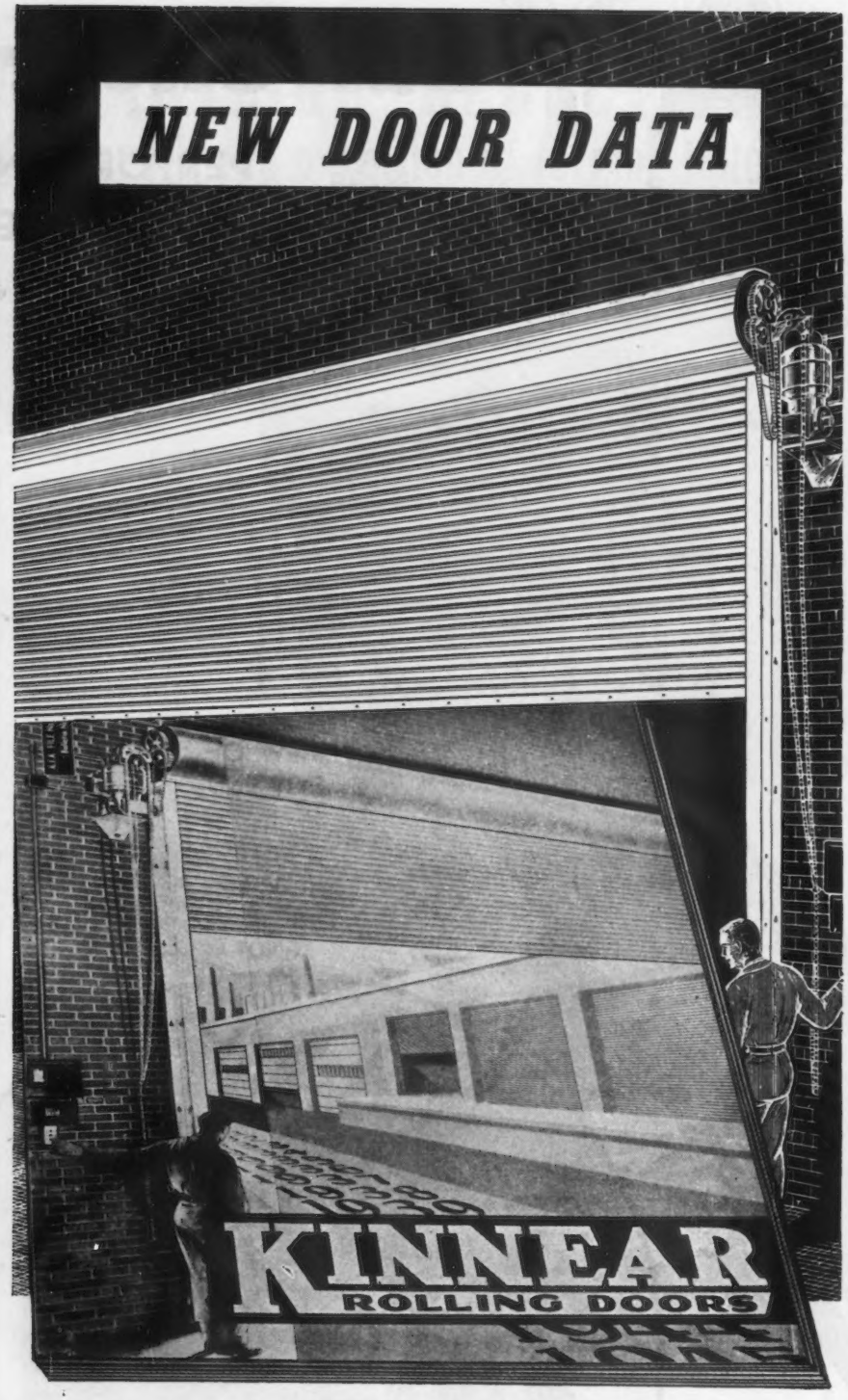


VIEW OF EXIT END

VIEW OF ENTERING END



The McKAY MACHINE Company
ENGINEERS AND MANUFACTURERS OF SHEET, TIN, AND STRIP MILL EQUIPMENT
YOUNGSTOWN, OHIO



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You'll want this up-to-the-minute data! It brings you 40 pages of fully illustrated information on doors for every requirement—complete facts on the exceptional space-economy, adaptability, ruggedness, convenience and protection of the *coiling upward action* featured by Kinnear Rolling Doors . . . ample specifications and installation data . . . *plus* all the facts on Kinnear Wood and all-steel RōL-TOP Doors, Bifold Doors, "Akbar" Rolling Fire Doors and Shutters, Kinnear Motor Operators, Steel Rolling Grilles, and other types of Kinnear Doors and door equipment.

THE KINNEAR MANUFACTURING CO.
1760-80 Fields Ave., Columbus 16, Ohio

SAVING WAYS IN DOORWAYS — KINNEAR ROLLING DOORS

WLB Approves Special Rate Structure For Standard Steel Spring

Washington

• • • **The War Labor Board** on July 1 approved as a rare and unusual case involving the critical needs of war production, a special rate structure for a new plant of the Standard Steel Spring Co., at Madison, Ill., so that the plant may begin production of axles for heavy trucks.

The case had been accepted by the WLB as a "rare and unusual" case on May 18, at which time it authorized the company to establish a hiring rate of 75c. an hr., reviewable before July 15, and a rate range for tool and die makers of $1.35 to $1.55. At the same time it directed the company and the USWA-CIO, which had joined in the company's application to negotiate a schedule of wage rates for other occupational classifications and to present them to the board for approval.

In a supplemental ruling, the board modified wage rates proposed by the company and the union pursuant to the May 18 direction and approved a special hiring rate for tool and die makers and a night shift differential of five cents for the second shift and 10 cents for the third.

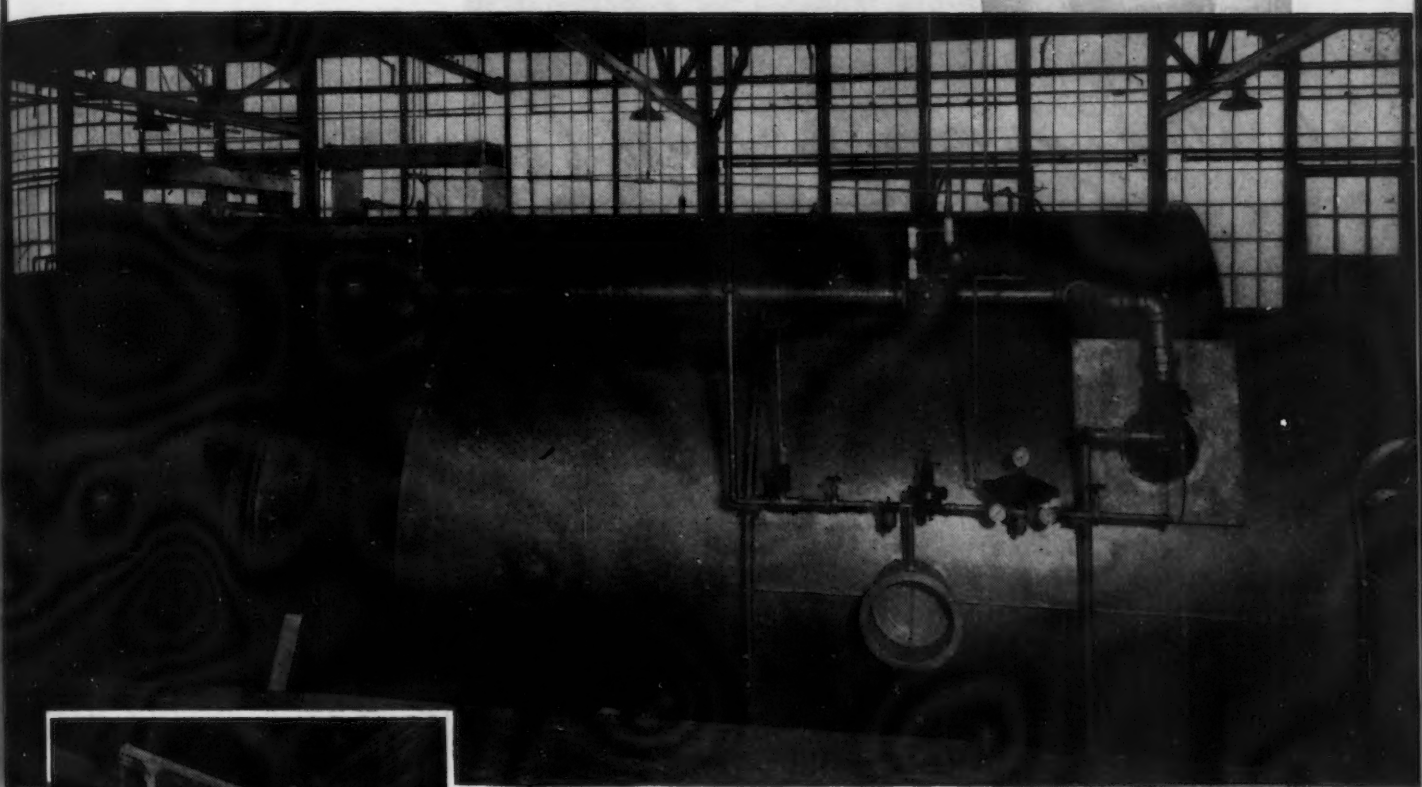
The proposed rates were reduced by an average of about seven cents an hour to rates averaging approximately one and a half cents above the weighted average of the midpoint of the bracket of sound and tested going rates for the area, labor members dissenting.

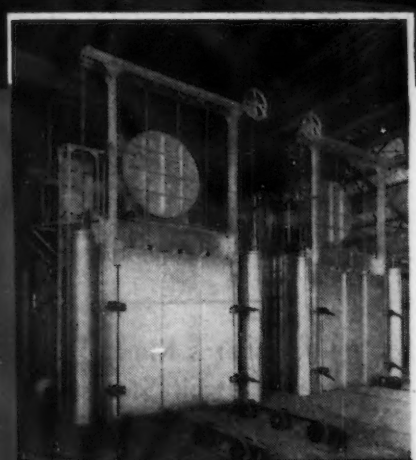
In regard to tool and die makers, the board unanimously approved a hiring rate of not more than $1.65 an hr., the going rate in the area, for not more than eight specialist tool and die jobs up to Sept. 15, 1944. After that date, employees already hired at that rate will continue at the same rate, but no new employees may be hired in that classification.

NWLB Approves Increase

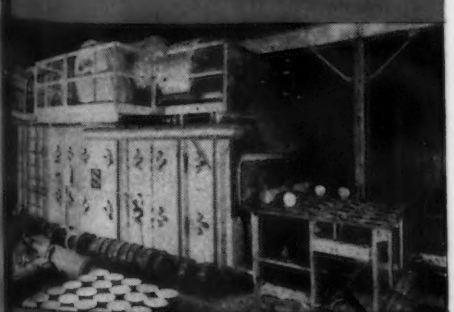
• • • **A five per cent** bonus for approximately 4000 hourly rated employees in three plants of the Doehler Die Casting Co. has been unanimously approved by the National War Labor Board to correct intra-plant inequities between earnings of incentive and non-incentive workers. This bonus is subject to the provision that the parties should report to the board the end of six months as to the results of the plan in action.

CONVECTION FURNACES *by* SALEM





Salem Dolly Car Type Furnaces for heating plates and sheets, weldments and jigs



Salem Chain Conveyer Type Furnace for heating round, aluminum billets

War Production Has Proved Convection Heating Most Efficient, Low-Cost Method . . .

Convection heating for low-temperature work (300° F.-1350° F.) costs less, delivers heat to all parts of charge at same time, acts faster than direct-firing, and is much cleaner than all other gas or oil-fired types.

Heating engineers predict that convection heating, as a result of its proved efficiency and economy, will be widely adapted to peacetime production when the goal of every manufacturer will be quality at lowest cost.

Salem Engineering Company builds convection furnaces in a complete range of sizes and styles . . . for heat treating, stress-relieving, aging . . . for ferrous or non-ferrous materials in billets, sheets, plates, castings . . . weldments, jigs, or fixtures.

In organizing your planning, talk over your heat treating ideas with Salem engineers. They can point out many time and cost-saving steps.

SALEM ENGINEERING COMPANY

SALEM ENGINEERING CO. · SALEM, OHIO

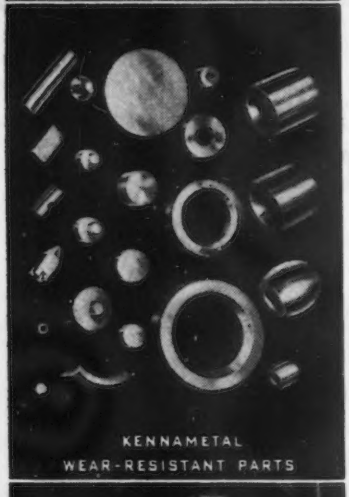
This unique piece of metal

KENNAMETAL-TIPPED TOOL - STYLE NO. 12

... SOLVES MACHINING PROBLEMS ...

"Too tough to machine, too hard to work"—time and again these words by production men sounded the death knell of designers' specifications. That is, until the discovery of Kennametal, the unique cemented carbide composition whose amazing hardness immediately established it as a tool material that makes practically any metal easy to cut. Kennametal-tipped tools swept away traditional machining limitations—making practical the cutting, boring, and milling of materials up to 550 Brinell at speeds that multiply output, and substantially reduce production time and costs. This application of Kennametal is a tremendous aid to better machine design, since it permits the use of tough, hard, lighter-weight parts instead of cumbersome components that were incorporated primarily because of their "machinability." Write for our Catalog 43-C that describes Kennametal tools. Study it with your production men—learn how to use the most advanced metal-cutting technique to improve your designs.

PIECES MACHINED WITH KENNAMETAL-TIPPED TOOLS



KENNAMETAL WEAR-RESISTANT PARTS

... IMPROVES PRODUCT PERFORMANCE...

Incredibly hard Kennametal (80.6 on the Rockwell C scale) delights designers who have been plagued by machine failure caused by abrasive or corrosive wear. Kennametal is up to 250 times as wear-resisting as steel. Its use at strategic points nullifies effects of friction and corrosion, assuring lasting precision performance. Complete Kennametal parts can be manufactured by us for use in your machines. Or —inserts of Kennametal can be easily incorporated into wear-areas. They are supplied . . . (1) accurately formed to desired shape, for brazing and finish grinding in your shop . . . (2) mounted on parts furnished by you, after which finishing is done either by you or by us . . . (3) embodied in complete parts produced by us. Don't let "wear" worry you —write us about your problem, and we'll show you how Kennametal can solve it.

KENNAMETAL INSERTS ON TABLE GRINDER

KENNAMETAL

SUPERIOR CEMENTED CARBIDES

KENNAMETAL Inc., LATROBE, PA.

Du Pont Aids Rubber Output of Soviet Union

Wilmington, Del.

• • • As the result of negotiations undertaken at the request of the U. S. Government, E. I. du Pont de Nemours & Co. is making its neoprene synthetic rubber process available to the Soviet Union. Full technical details necessary for building and operating plants to produce neoprene, the first successful general-purpose synthetic rubber ever developed, are being sold to the People's Commissariat of the Rubber Industry of the U. S. S. R. under an agreement dated June 22, 1944.

The du Pont policy is to grant to the U. S. Government free rights under its patents and processes for military purposes during the period of the war, and as this process is made available through negotiations undertaken at the request of the U. S. Government no compensation is being asked of the Soviet Union for the production of neoprene while Russia is at war with Germany. The amount of compensation in the postwar period will depend upon the volume of Russian production of neoprene.

The agreement covers the principal type of neoprene, designated by the government as GR-M and by du Pont as Neoprene Type GN. From this type a large number of neoprene compounds can be formulated to fit a great variety of applications.

Steel Concerns Merge To Form Detroit Steel Corp.

Detroit

• • • Operations of Detroit Steel Corp. and Reliance Steel Corp. were consolidated under the name of Detroit Steel Corp. as of July 1. Mill operations of the Detroit Steel Corp. division will continue at Detroit, and the Reliance Steel division will headquarter at Cleveland, as formerly.

Under the new merged setup, warehouses will be maintained at Detroit, Cleveland, Chicago, Worcester, Mass., and Lyndhurst, N. J. Sales offices will be maintained at Philadelphia, New Haven, Washington, Indianapolis, Grand Rapids, Toledo, Los Angeles and Windsor, Ont.

The new officers of the company are M. J. Zivian, president, associated with Detroit Steel since its start in 1923. J. B. Ribakoff, former president of Reliance heads the new Reliance Steel division as general manager.

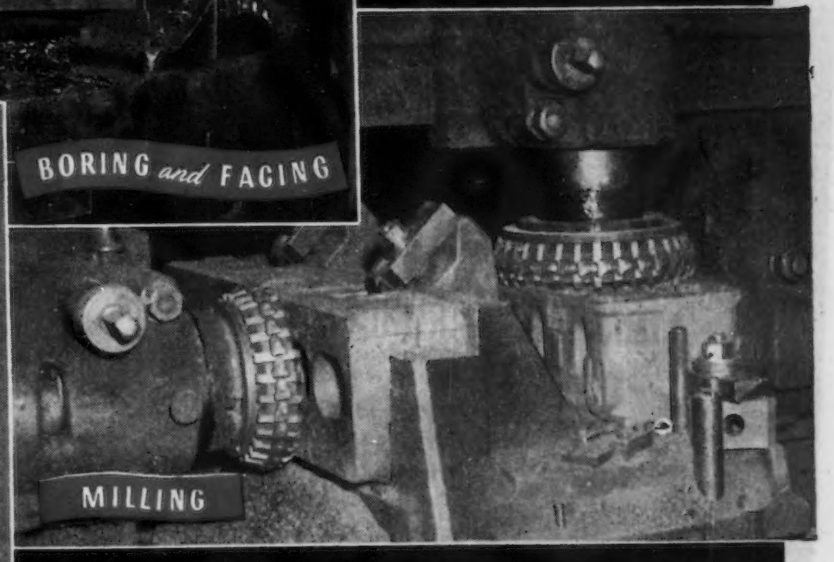
LATROBE

RED ARROW 101

for

METAL CUTTING TOOLS

BORING *and* FACING



MILLING

*What users say!**

SUPERIORITY

"Grooving brass shells at 860 S.F.M. We get 10,000 to 11,000 pieces per grind compared with 6,600 pieces per grind with former tools."

LONGER TOOL LIFE

"Your Red Arrow 101 has been running 40 hours between grinds at 400 S.F.M. on grey iron. Our operators like it better because cutting edges do not break down and that means more production faster."

TOUGHNESS

"We are machining steel rings which are welded and steel castings with intermittent cuts. We plan to use Red Arrow 101 on all our tough jobs."

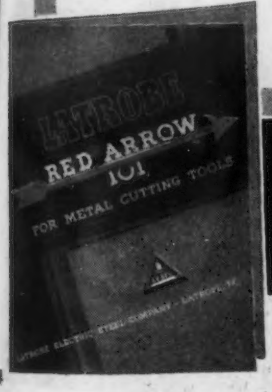
LESS TOOL GRINDING

"We find Red Arrow 101 very satisfactory. It runs double the production of other tools we have used on our boring jobs."

HIGHER SPEEDS

"Red Arrow 101 tool bits enable us to increase the surface speed 100% with four times the tool life."

**Selected at random from field reports.*



Write for this Bulletin ←

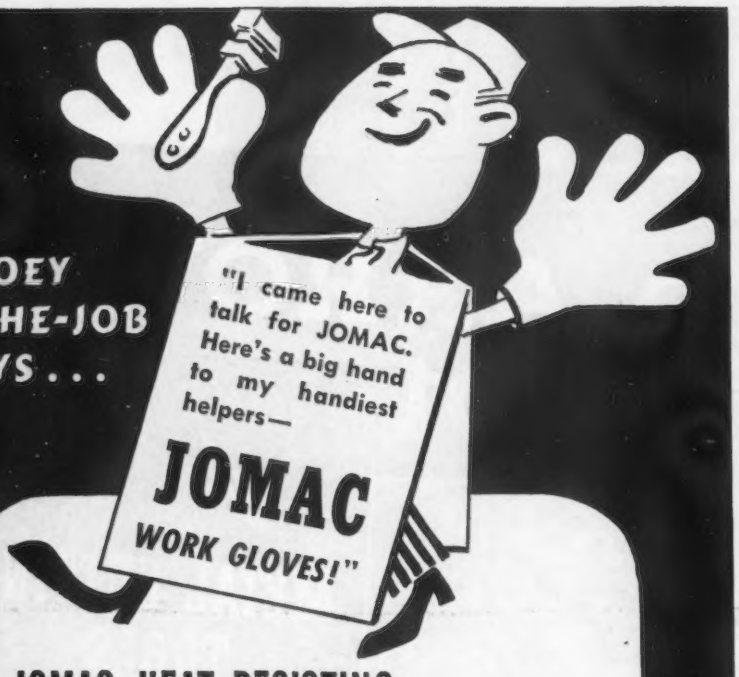
Latrobe RED ARROW 101—the Cobalt-Chromium-Tungsten alloy that can be cast into many types of metal cutting tools—is furnished in the "as cast" state ready for grinding to finished tool dimensions. Improved casting technique enables us to produce castings of such uniform structure that "notching" of the gate end of Tool Bits is unnecessary. Standard Tool Bits are carried in warehouse stocks.

Latrobe RED ARROW 101 requires no heat treatment; is easily brazed to tool shank or body; will operate at greatly increased speeds and effect valuable savings in production time.

Ask our service department to help you with any problem concerning the use of Latrobe RED ARROW 101—either applications, speeds, grinding, brazing or any othe detail.

Latrobe ELECTRIC STEEL COMPANY

MAIN OFFICES *and* PLANT · · LATROBE · PENNSYLVANIA



JOMAC HEAT-RESISTING, LONG-WEARING GLOVES

They are proving themselves in hundreds of shops where workers must handle metals too warm to touch. The remarkable Jomac Fabric is a loop-finished cloth with air-cell "cushions" which allow breathing-space and an easy dissipation of heat. Jomac's loop finish gives extra protection to hands, extra *long wear.*

JOMAC REGULAR INDUSTRIAL GLOVES

A modern work-glove that is semi-heat resisting and gives as much as *7 times the service* of ordinary work gloves. Jomac Fabric and its hidden lock-stitch keep the thick pile in place and provide extra strength and wear. Jomac Gloves can be washed repeatedly, *kept clean* . . . and thus minimize the dangers of dermatitis and other skin infections.

TEST THEM!

Just try JOMAC GLOVES on your stiffest jobs. Test them for heat-resistance, for wear, for washability, for economy, for *increased production.* Write for full details.

JOMAC WORK GLOVES

C. WALKER JONES CO.

6135 N. Lambert St., East Germantown, Philadelphia 38, Pa.

Bureau Report Shows Electronic Advances

Washington

• • • **Electronic developments** have made an invaluable contribution to metallurgical research, improving old methods and opening new avenues of approach, Dr. R. R. Sayers, director of the Bureau of Mines, said in announcing publication of a Bureau report on use of electrical devices in metallurgical research.

Physical metallurgy is a field in which the bureau has found electronic devices particularly useful, according to Physicist E. V. Potter of the Salt Lake City Experiment Station, author of the paper. He describes the more special and unusual applications in physical metallurgy, devoting the greater part of his report to this phase.

However, the bureau has done metallurgical research involving electronic devices in ore dressing, hydrometallurgy, pyrometallurgy, and electrometallurgy.

A copy of the report may be obtained for 10 cents by writing to the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., for Bureau of Mines Technical Paper 661, "Electrical Devices Applied to Metallurgical Research," by E. V. Potter.

BOMB SET UP: *Two USAAF ordnance men prepare 500 lb. high explosive bombs which are still on the bomb cart before lifting them into position in the bomb racks somewhere in England. This photo was taken from the bomber radio room directly above.*

The "Latest Thing" Then . . .

The Height of Fashion Now . . .

Brass is always Modern

Hooks and eyes were the streamlined fasteners of the 1800's. These devil's devices were the curse of husbands, but fashion decreed them, and wives did the rest. At the same time, utility decreed that . . . since each fastening must stand considerable strain, yet have resilience to resist breakage . . . the logical metal was Brass.

Now, a hundred years later, we have the easiest and smoothest and quickest of all fasteners . . . the pull-tab slide type . . . delight of clothes designers and merchandising men, pet of women and pal of men. And here again Brass is found, for these reasons: Resilience prevents sticking of the interlocking teeth. Then, too, the incorruptibility of Brass means that fasteners won't corrode in wet weather or damp climates. And in many cases the golden color of the Brass fastener is worked into the design of the clothes. So styles come and go, but Brass remains, in various changing forms.

These exclusive characteristics of Brass are good things to file in your mind for future reference. Remember, too, that Bristol Brass will be able to supply you with any alloy your product-uses require . . . in sheet, rod, or wire of uniform dimensions and quality. In fact, why not discuss the preliminaries now? Write to The Bristol Brass Corporation, Bristol, Connecticut.

BRISTOL BRASS

BUY BONDS TO BUY BRASS FOR BULLETS

If the Job is One of these 3—

Try INGERSOLL SPECIAL STEEL MILL SERVICE *first!*

1 If the job demands steel that will give proper resistance to corrosion.

2 If the job calls for the use of dependable heat-resisting alloy steels.

3 If stainless protection is required on only one side of the metal and you want to provide utmost stainless service within the limitations of your budget.

It will pay you to investigate the Ingersoll Special Steel Mill Service. Ask your Fabricator, or write...

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BORG-WARNER CORPORATION

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Originators and Producers of

INGACLAD
STAINLESS-CLAD STEEL
"A Borg-Warner Product"

✓ CHECK items in which you are interested

- ☐ Ingersoll Solid Stainless Steel
- ☐ Ingersoll Heat-Resisting Steels
- ☐ IngAclad Two-Ply Stainless-Clad Steel

All of the above steels in Chrome-Nickel Types

- ☐ Free Manual of Welding and Fabricating Procedures for IngAclad

New Peak Hit in Output Of Aircraft and Ships

Washington

• • • Aircraft output was marked by a 6 per cent increase in airframe-weight (including spare parts) which brought the program to a new peak. All major combat types met or exceeded schedules. The number of planes accepted was 8902. Weight output, at 102,418,000 lb. (including spare parts), surpassed by more than 1,000,000 lb. the record set in March, when deliveries hit a numerical peak of 9117 planes. More models were precisely on the mark in May than ever before, and in contrast to April, when the numbers schedule was missed by 4 per cent, May was 2 per cent ahead of the goal.

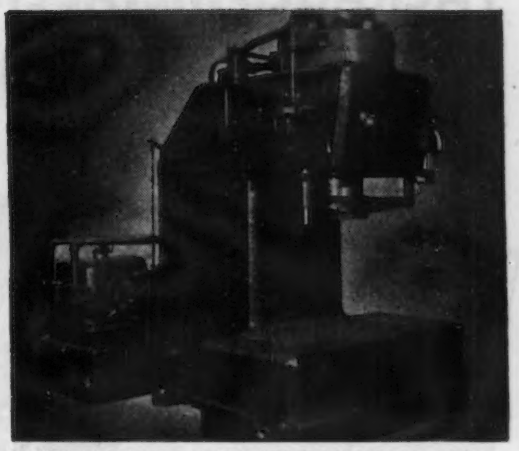
May was the biggest month in naval construction history. Ship completions jumped to an all-time high of over 400,000 displacement tons, or almost 100,000 over the previous peak of last November. The tonnage-output was 58 per cent higher than in April and 3 per cent more than the May schedule. The most spectacular performance was the output of the all-important landing vessels. Running about 10 per cent ahead of a steep schedule, landing vessel deliveries reached a total of 198,000 tons, more than 50 per cent above the record set in April. The spectacular showing of the November-May landing vessel program carried it within 12,000 tons of the 750,000-ton goal set, and the 12,000-ton deficit was more than picked up in the first week of June. The May peak in total ships completed will probably remain the Navy's all-time high for the war. Landing vessel schedules, for example, will taper off to a 132,000-ton level in October, but even this October low will still be higher than the peak prior to May, so that the importance of the landing vessel program continues to be very great.

The urgently needed heavy artillery (over 105 mm.) ran 26 per cent over the April level of production as scheduled. All types of big guns shared in the gains. Output of spare cannon also ran well ahead of forecast of 9 per cent below April; 13 per cent above the May goal. Heavy artillery ammunition, a recently increased program, was 4 per cent ahead of schedule.

Construction by the Maritime Commission, at 1,545,000 deadweight tons, was 3 per cent below the April output but 1 per cent over the May schedule. The drop in total output

THE QUANTITY PRODUCTION of electrodes to meet the requirements of war production has been, of course, our chief concern. Research and development work has not been neglected, however, and a continuous program devoted to the improvement of present electrodes and the creation of new ones is carried on continuously at our modern research laboratory in Woodbridge, N. J.

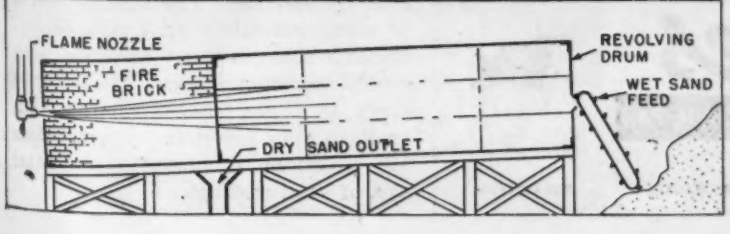
As a result of this important work, announcements of several new Murex electrodes will be made in the near future.



OILGEAR SPECIAL 200-300-TON GOOSENECK PRESS for straightening large, long tubes. Welded frame is made of steel plates from 1½" to 5" thick, is normalized after welding at 160° F. for about 8 hours and then sandblasted. ¼" Murex Fillex, 5/16" Murex Fillex and ¼" Murex Genex are used.

ERECTION OF A 30,000-TON UNIT SYNTHETIC RUBBER PLANT, one of six built by the Blaw-Knox Company, required approximately 11 miles of piping ranging in size from 2" to 30" which called for over 26,000 welds. These piping systems required designs for a wide variety of conditions, such as high pressures and temperatures, refrigeration, vacuum, hazardous liquids, gases and corrosive chemicals. Murex electrodes were used.

(Below) WELDS IN SAND DRYER WITHSTAND HEAT EXTREMES AND ABRASION. 450 tons of sand pass through this revolving dryer cylinder during eight hours' operation at red heat temperature which sometimes drops below zero after shutdown. Welded with Murex Molex electrodes, the welds outlast the dryer's half-inch steel liner plates. The liner plates are made in three segments, with a girth weld and 3 horizontal welds for each section.



MUREX
ARC WELDING ELECTRODES
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METAL & THERMIT CORPORATION
120 Broadway, New York 5, N. Y.
ALBANY • CHICAGO • PITTSBURGH
SOUTH SAN FRANCISCO • TORONTO
Specialists in welding for nearly forty years. Manufacturers of Murex Electrodes for arc welding, and of Thermit for repair and fabrication of heavy parts.

"PACKAGED METAL ENGINEERING*"

gives *Your* postwar production problems a PIECE PLAN—

★ MANUFACTURE OF PARTS AND PRODUCTS
★ AID IN RECONVERSION, SUPPLY NEW "KNOW-HOW"
★ CREATE NEW PRODUCTS, REDESIGN OLD ONES
★ ADD TO YOUR PLANT FACILITIES WITHOUT INVESTMENT
CONTRACT SERVICE
BY Grammes
L.F. GRAMMES & SONS

Without relaxing its all-out war production drive, management is proceeding with its peace plan for civilian goods production. Manufacturers faced with transition problems of *machinery changeover and retooling, inadequate plant facilities, inexperienced help, lack of "know-how", creation of new products, and improvement of existing products,* will be interested in the *piece plan* of Grammes Contract Service for fabricating parts and products.

Grammes Contract Manufacturing Service can be your *complete* manufacturing source, providing the all-inclusive services and facilities of "Packaged Metal Engineering"—**in one package . . . in one service . . . we take over* ALL *responsibility, acting as* YOUR *factory from Design Research to Drop Shipments.* Grammes specialized Metal Working Engineers with more than 69 years of metal fabrication "know-how" plus mass-production facilities can save you time, money, and materials on your product. Let us quote a "per piece" price on your product.

The listed production facilities, all under one roof, provide a complete, versatile and economical set-up for fabricating and assembling metal parts into complete products with precision control.

Though 100% in war work our Research, Design, and Engineering services are available NOW for idea development and product improvement. Let our *sales-minded* executives work with you, in complete confidence.

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- HARD ENAMELING
- SCREW MACHINES
- DRILLING
- WELDING
- MACHINING
- SPRAYING
- HEAT TREATING
- PLATING
- ENAMELING
- TOOLS & DIES
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DECORATED METAL PRODUCTS SPECIALISTS

—applying artistic designs and finishes that add beauty and color to your product.

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"MASTER CRAFTSMEN IN METAL"

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L. F. GRAMMES & SONS, INC., ALLENTOWN, PA.

ESTABLISHED 1875

NEW YORK CHICAGO DETROIT CLEVELAND MILWAUKEE PHILADELPHIA

was largely due to the declining Liberty ship program.

Output of munitions for the ground army came through about as planned. Production declined generally, but ran ahead of schedule, except for automotive vehicles and small arms. The best performance was in heavy artillery, as already noted. The failure of automotive vehicles to meet schedule was due primarily to heavy-heavy trucks (over 2½ tons), which dropped 3 per cent below the April level and were 3 per cent short of schedule. Trucks of 2½ tons and under met their schedule.

Communication and electronic equipment was down 2 per cent below April production and missed schedule by 5 per cent. Radio was down 5 per cent from April and 5 per cent short of the goal. Wire communication, underwater sound, and miscellaneous signal equipment were up 4 per cent from April and exactly on schedule.

Pre-Fill Injection System For Die Castings

(CONTINUED FROM PAGE 69)

same die. (Unfortunately the flaws of the defective castings will not show in an X-ray positive print, although the flaws are easily seen in the inspection negative.)

The defective castings were made with the metal temperature 1260 deg., cycle time 8 sec., a relatively low injection velocity, front die temperature 350 deg. and rear die temperature 500 deg.

The perfect castings were made with the metal temperature 1300 deg., cycle time 8 sec., a relative high injection speed, front die temperature 410 deg. and rear die temperature 450 deg. An increase in the area of gate might permit a lower injection speed.

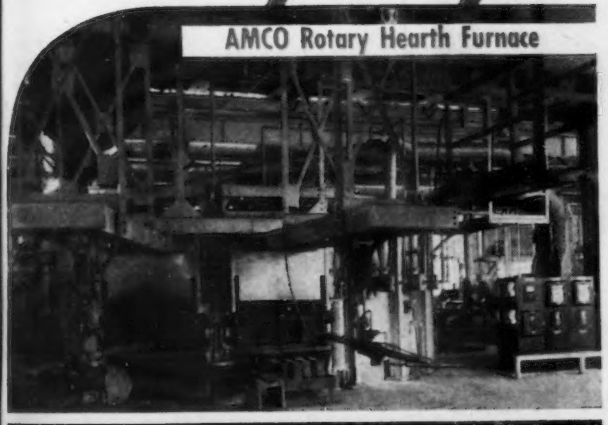
Fig. 6 shows two castings (not made by National Cash Register) which demonstrates the increasing scope of die casting so far as size and weight are concerned. These aircraft parts, 16 in. in diameter and weighing 9½ and 12 lb. respectively, are being produced at the rate of 30 or more per hour.

Until recently these parts could be made only by sand casting or permanent mold casting because of their unusual area, the large volume of metal required, and the extremely thin angular fins. The heavier one is of aluminum-silicon alloy on a Lester-Phoenix Die Casting machine with pre-fill injection system. The other is made on a long stroke machine with single acting injection system. Both are produced at one-fifth the total cost of sand castings.

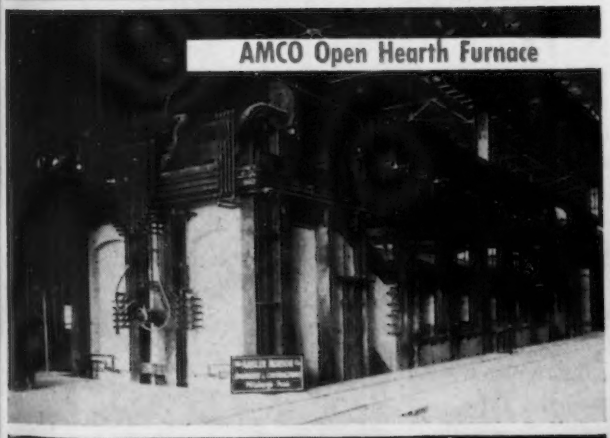
AMCO Equipment FOR

AMCO Pit Furnace

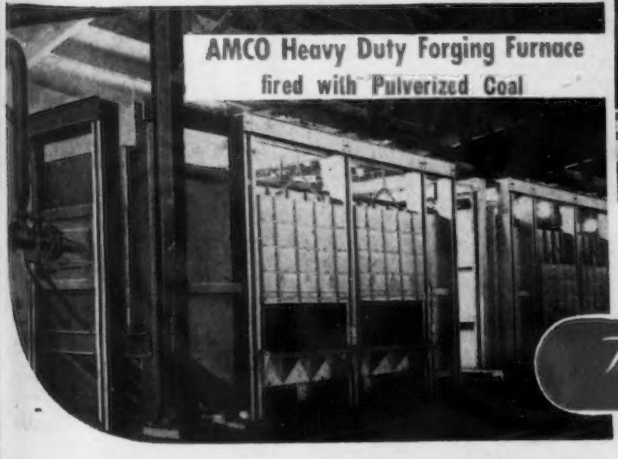
HEATING · MELTING ANNEALING



AMCO Rotary Hearth Furnace

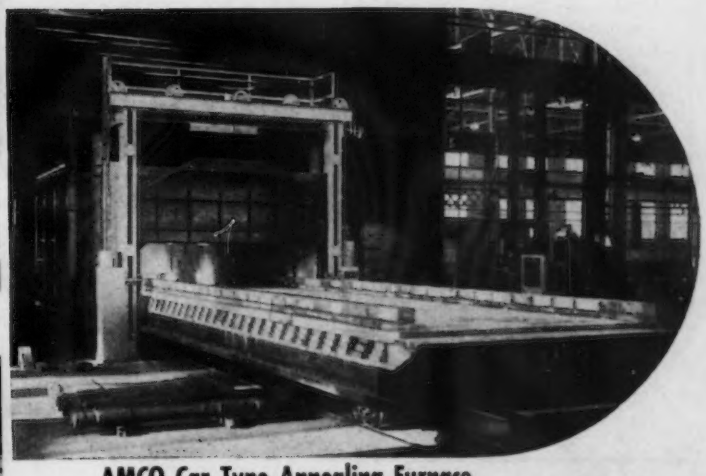


AMCO Open Hearth Furnace



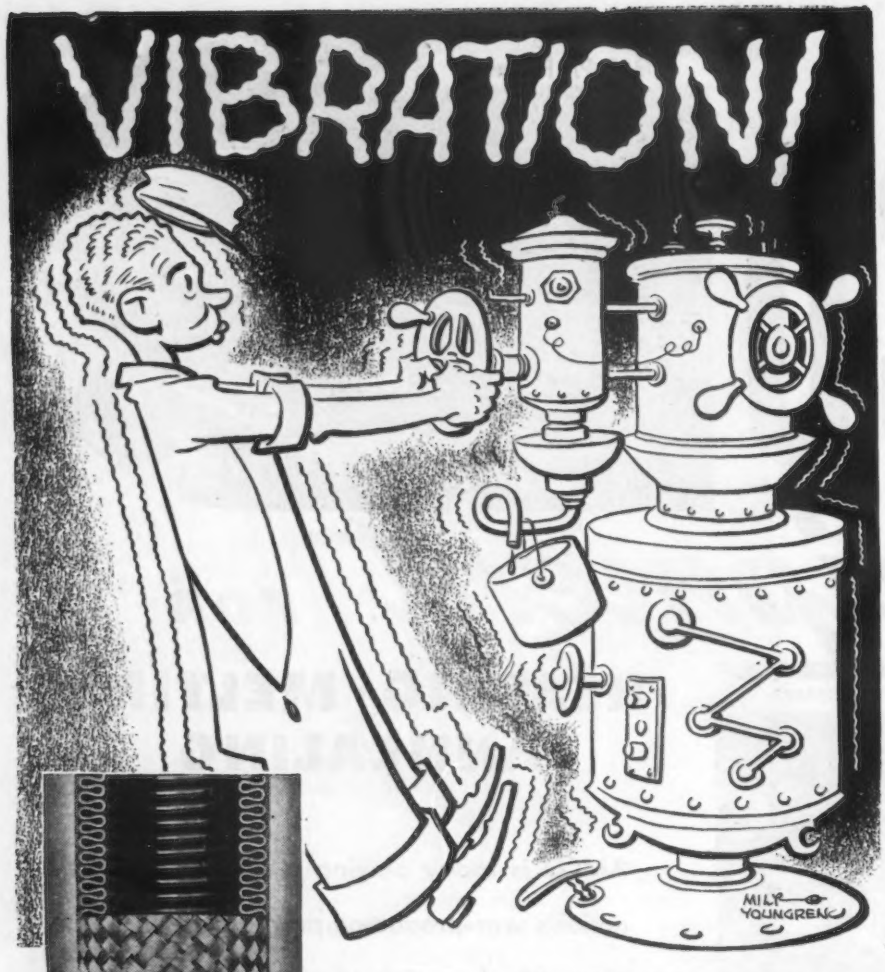
AMCO Heavy Duty Forging Furnace
fired with Pulverized Coal

AMCO is today playing a vital part in the nation's war-production program, resulting in a wealth of specialized experience that is at your command now or for post-war planning, to meet the widely varied problems of heating, melting and annealing.



AMCO Car Type Annealing Furnace

The AMSLER - MORTON Company
FULTON BUILDING · PITTSBURGH, PA.



OUR ENGINEERS will recommend the type of flexible tubing most adaptable to these uses—

1. For conducting liquids from a vibrating to a stationary medium.
2. For high fatigue resistance under constant vibration.
3. For handling searching liquids without seepage.
4. For extreme temperature conditions.
5. For use where corrosion resistance is a factor.
6. For conducting liquids and gases to reciprocating parts.
7. For maximum flexibility with a minimum of length.
8. For dampening noise between two units that must have pipe connections.
9. For correcting misalignment.

REX-WELD Flexible Metal Hose CONTROLS IT

Chicago Metal Hose Corporation's REX-WELD is highly resistant to fatigue even when subjected to constant vibration over long periods of time. It is extremely flexible and remains airtight and leakproof after years of hard usage. It stands up under high temperature and prolonged flexing. REX-WELD is fabricated from strip metal and is precision autogenous welded to form a weld stronger than the tube itself. Write, giving complete information and we will be glad to furnish engineering recommendations for any design problem.

Flexible Metal Hose for Every Industrial Use

CMH CHICAGO METAL HOSE CORPORATION
MAYWOOD, ILLINOIS

Plants: Maywood and Elgin, Ill.

The Steel Industry's Record in the War

Source: "Steel's War Record," by The American Iron & Steel Institute

	Production of Steel Ingots and Castings, Net Tons	Production of Alloy Steels, Net Tons
1939	52,800,000	3,200,000
1940	66,900,000	4,900,000
1941	82,800,000	8,200,000
1942	86,000,000	11,500,000
1943	88,900,000	13,100,000

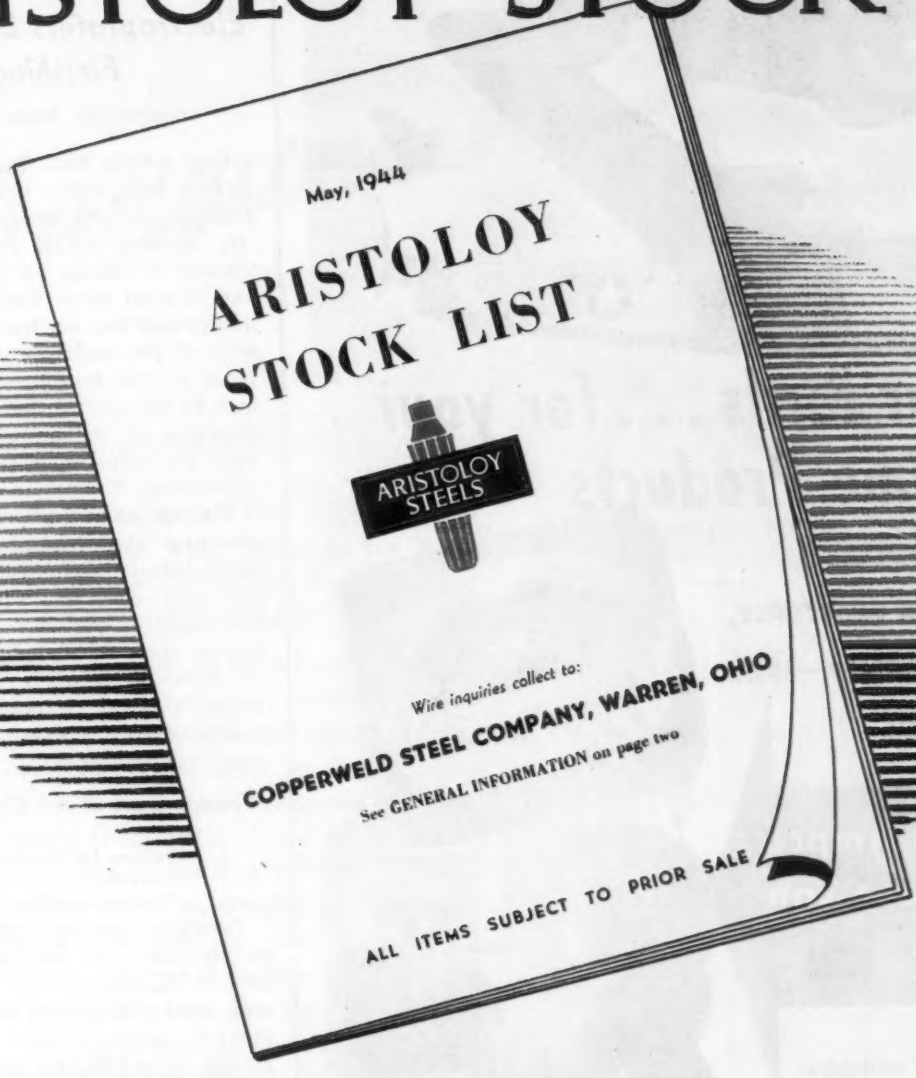
	Capacity of Pig Iron, Net Tons	Production of Pig Iron and Ferroalloys, Net Tons
1939	56,300,000	35,600,000
1940	55,700,000	47,400,000
1941	57,600,000	56,700,000
1942	60,300,000	60,900,000
1943	63,900,000	62,800,000
1944	67,400,000	.....

	Production of Iron Ore, United States, Gross Tons	Shipments of Lake Superior Iron Ore, Gross Tons
1939	55,000,000	45,000,000
1940	75,000,000	64,000,000
1941	94,000,000	80,000,000
1942	106,000,000	92,000,000
1943	.....	84,000,000

	Production of Steel Plates, Net Tons
1939	3,100,000
1940	4,300,000
1941	6,200,000
1942	11,800,000
1943	13,100,000

RING SAVER: *Mrs. La Verne Becker developed a cadmium plating process which resulted in saving 4500 oversize filler rings in Los Angeles. The rings, important fitting on bullet-sealing gas tanks, had been rejected until she developed a way to reduce them to proper size.*

ARISTOLOY STOCK LIST



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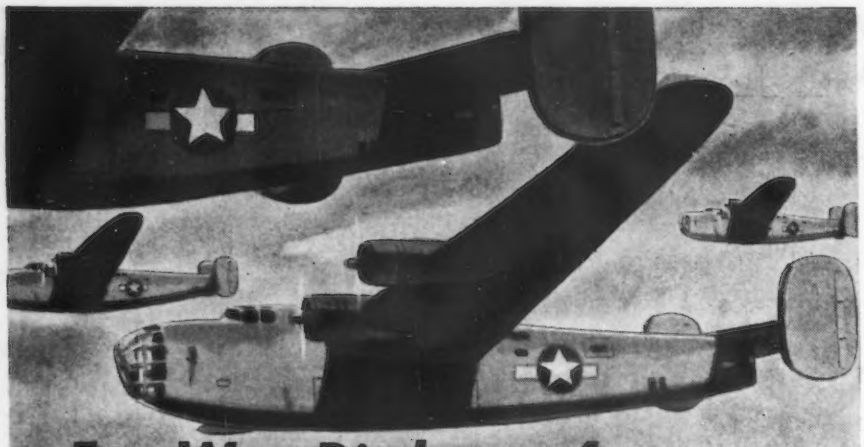
STAINLESS STEELS • BEARING QUALITY STEELS
AIRCRAFT QUALITY STEELS • NITRALLOY STEELS

ARISTOLOY STEELS



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FEATURE CONTINUATIONS

Electroplaters Discuss Finishing Methods

(CONTINUED FROM PAGE 65)

taking a very high finish. The chief metals onto which indium is plated and diffused are lead, cadmium, zinc, tin, copper, silver and gold. The amount of indium used is very small and in most cases does not exceed 5 milligrams per sq. inch. The thickness of the undercoatings will vary from a few ten-thousandths of an inch to one or two thousandths. The thickness of indium will, of course, vary depending upon the surface requirements.

Plating technique was described, stressing the cleaning of the base metal before plating, racking, rinsing, etc. and describing the necessary equipment.

Indium may be plated by a number of methods, including the following baths: Cyanide, sulphate, fluoborate, sulphamate. The cyanide bath is the most widely used.

Composition of the Cyanide Bath

	oz. per gal.
Indium (as chloride)	4 (Troy)
Dextrose	2
Sodium cyanide	12

Insoluble anodes, such as carbon on platinum, are used and a current density sufficiently high to give gassing at the cathode is employed. The current density range is approximately 10 to 100 amp. per sq. ft. The rate of deposition of a new bath will be approximately 15 milligrams per amp.-min. and after the bath is used, or aged, the rate of deposition gradually falls off until it reaches a constant value, ranging from 5 to 8 milligrams per amp.-min. Depletion of metal in the bath, or of the free cyanide, may still lower the rate of deposition, at which time additions should be made to maintain the efficiency of the bath.

Since insoluble anodes are used, all metal plated is from the bath, and must be replaced by additions to the bath. The cyanide content should not be allowed to fall below 11 oz. per gal. or 90 grams per liter; preferably maintained at 11 to 13 oz. per gal. or 90 to 100 grams per liter. The indium content should not fall below 3 oz. per gal. for consistent plating results.

The sulphate and the fluoborate baths were also described.

In order to meet the request for an efficient acid bath, a sulphamate solution was developed. It has the lowest inventory value, and the highest cathode efficiency of any bath now

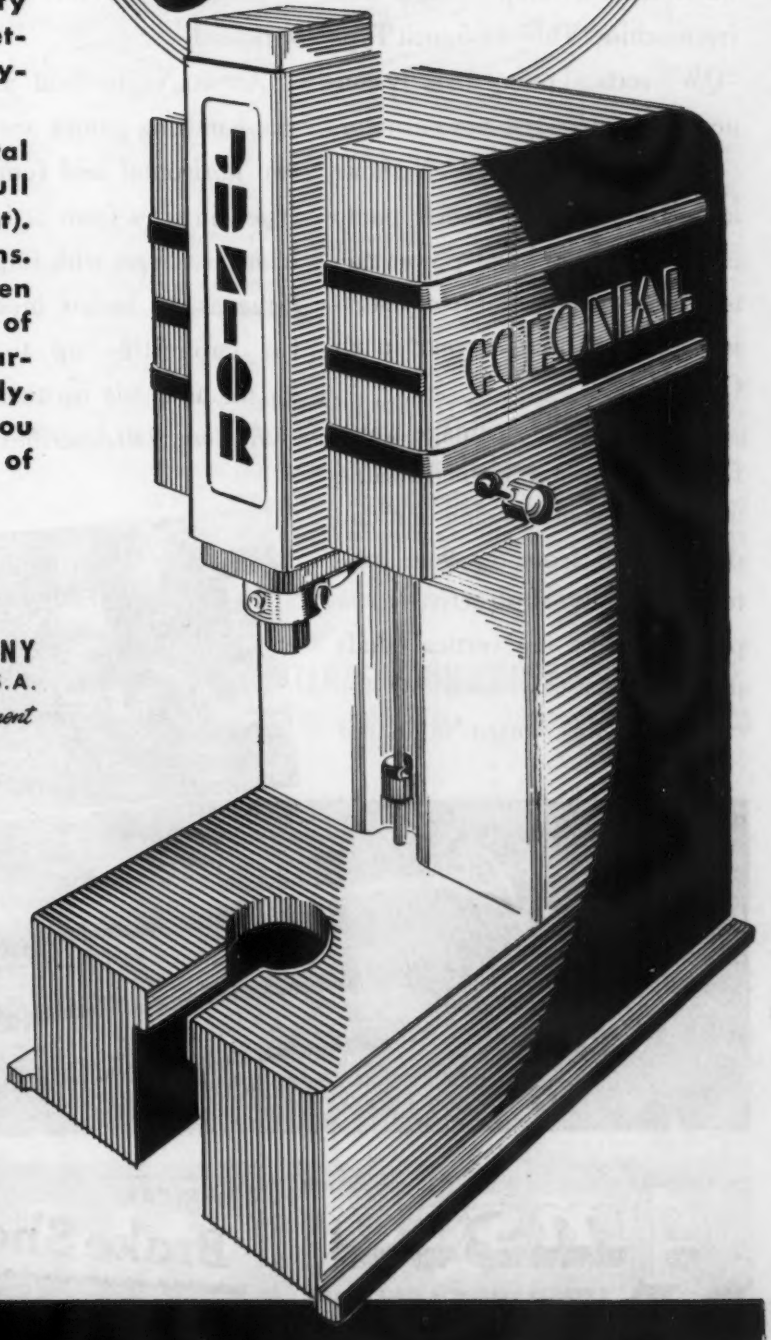
Announcing... New JUNIOR PRESSES by Colonial

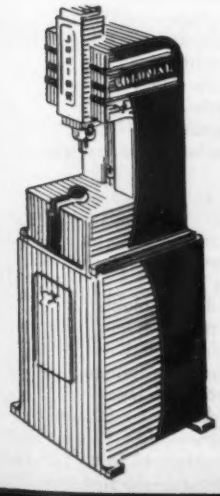
For light duty broaching or for assembling where pressures up to 4 tons are required, or for light duty straightening, etc., there is no better press than Colonial's new all hydraulic line of "JUNIORS".

Available either in bench or pedestal types and for either push or pull broaching (with special attachment). Capacities from one to four tons. Machined and counterbored platen for easy installation and location of fixtures. Plenty of daylight and clearance. Compact, powerful and sturdy. Remarkably low in cost when you consider the tremendous variety of jobs these presses can do.

For complete technical data write for Bulletin No. VJI-44

colonial BROACH COMPANY
DETROIT 13, U.S.A.
Broaches Broaching Machines - Broaching Equipment





***Right*–Bench type all-hydraulic Junior Press. Also available with variable speed and pressure controls and pressure gage.**

***Left* – Pedestal type Junior for press work or broaching. Also available, equipped for pull broaching.**

These Sturdy Pumps—
Find Many Uses in Steel Plants

Two instances of many where Amsco-Nagle pumps are giving superior performance in steel production operations are illustrated here.

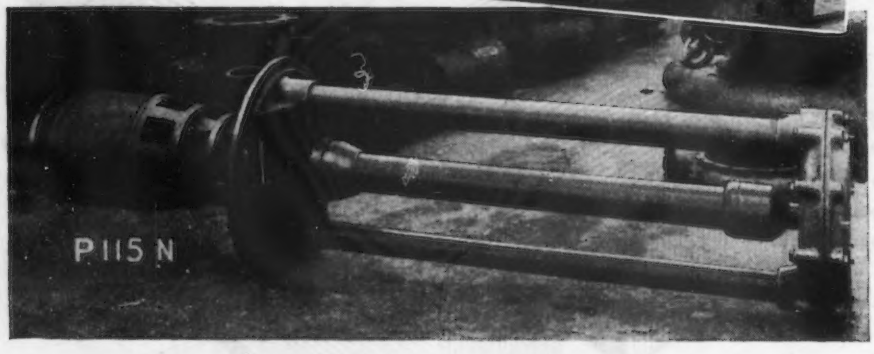
An Indiana plant employs two of the units shown in P-115-N for pumping spent spray cooling water from a sump at a pig-casting machine. This is a 5 inch Type "QW" vertical pump directly connected to a 15 horse-power motor.

The other photo P-63-N shows a horizontal type 4 inch pump coupled to a 30 horse-power motor. It has given satisfactory service for more than a year in an Ohio plant.

It removes the drainage water from a sump at a 35 inch rolling mill which contains slag and cinder drained from the floor, material usually destructive to a pump. Unlike the vertical shaft pumps previously used for the same work, this Amsco-Nagle unit need not be removed from the pit for servicing, being installed 15 feet above the water level. Self-priming, it is turned on and off by a float-control throughout a 24 hour day. Priming takes one minute, draining the sump a half-minute, and then the pump stops a half-minute before the cycle is repeated.

Amsco-Nagle fluid and material-handling pumps are made in two horizontal and four vertical types, in sizes from ¾ inch to 16 inch discharge, with impellers as large as 48 inches in diameter, for capacities up to 10,000 g.p.m. at heads up to 200 feet.

Bulletin 940 describes them all.



Amsco
AMERICAN MANGANESE STEEL DIVISION
Chicago Heights, Illinois
FOUNDRIES AT CHICAGO HEIGHTS, ILL.; NEW CASTLE, DEL.; DENVER, COLO.; OAKLAND, CALIF.; LOS ANGELES, CALIF.; ST. LOUIS, MO.
OFFICES IN PRINCIPAL CITIES

AMERICAN Brake Shoe COMPANY

FEATURE CONTINUATIONS

known. It operates satisfactorily with 20 grams per liter or about 2½ oz. of indium metal per gal. This is about the same as the sulphate bath, is about 60 per cent of the content of the cyanide solution and about 25 per cent of the content of the fluoborate solution. The throwing power is excellent, the quality of the plate is good, and the anode efficiency of indium anodes is about 100 per cent. The cathode efficiency is about 90 per cent. The current density is as high as any bath and it is not critical. The bath has suitable wetting agents, but it is still an acid bath and the precleaning must be adequate. The solution is clear and stable. The indium content is supplied by indium anodes and the efficiency of the bath is maintained by control of the pH and the indium content.

Summarizing, the four baths above discussed have the following characteristics:

1. **Throwing Power**
   Cyanide—excellent
   Sulphate—poor
   Fluoborate—good
   Sulphamate—excellent
2. **Quality of Plate**
   Cyanide—excellent
   Sulphate—possible
   Fluoborate—good
   Sulphamate—excellent
3. **Ease of Solution Analysis**
   Cyanide—not too easy
   Sulphate—easy
   Fluoborate—easy
   Sulphamate—easy
4. **Critical Temperature**
   Cyanide—no
   Sulphate—controlled
   Fluoborate—70 to 90 deg. F.
   Sulphamate—no
5. **Metal in Solution**
   Cyanide—4 oz. per gal.
   Sulphate—2½ oz. per gal.
   Fluoborate—11 oz. per gal.
   Sulphamate—2½ oz. per gal.
6. **Color of Solution**
   Cyanide—dark
   Sulphate—clear
   Fluoborate—clear
   Sulphamate—clear
7. **Wetability**
   Cyanide—easy
   Sulphate—difficult
   Fluoborate—difficult
   Sulphamate—fairly easy
8. **Use**
   Cyanide—general
   Sulphate—experimental
   Fluoborate—experimental
   Sulphamate—experimental
9. **Anode**
   Cyanide—insoluble
   Sulphate—indium
   Fluoborate—indium
   Sulphamate—indium
10. **Cathode Efficiency**
    Cyanide—40 to 50 per cent
    Sulphate—30 to 70 per cent
    Fluoborate—40 to 45 per cent
    Sulphamate—90 per cent
11. **Tendency to Pit**
    Cyanide—no
    Sulphate—yes

MORE SURFACE GRINDING

GRINDING TIME REDUCED to 15% of Former Standard!

The proof piles up—through actual War Production Test Runs in busy plants . . . and Cortland Chucks and Segments are winning with outstanding performance.

For instance: A Production Test on a Blanchard No. 18 Vertical Surface Grinder by a manufacturer of filing machines and band saws. Wheel speed 705 R.P.M.

WORK: Saw tables for Vertical Band Saw Machines —close grained gray iron, not machined before grinding; 547.49 sq. in. top side; 1 piece per table load.

Here are the amazing Production Test facts—showing how Cortland Chucks and *Diagonal Shearing* Segments beat another brand by more than 6 to 1 in grinding performance.

Detail	CORTLAND Chuck and Segments	*Competitive Brand of Sectored Cylinder*
Cubic inches of stock removed per inch in height of segments	418.81	38.12
Ampere readings	50	75 to 100
Dressings necessary	None	1
Work heat?	No	No
Grinding time	79 secs.	528 secs.

In addition to the great saving in grinding time, 6½ times more stock was removed by Cortland Chuck and Segments per unit height of abrasive.

Why not find out how Cortland Chucks and *Diagonal Shearing* Segments can increase the quality and quantity of your grinding output? Write for latest illustrated bulletin giving complete story of Cortland performance.

CORTLAND GRINDING WHEELS CORP.
7 Cortland Street Chester, Massachusetts

Diagonal Shearing with Varying Contact Means Better Surface Grinding

A true segment, the grinding surface has narrow ends that *start* the work with minimum shock and resistance. Straight inner edge of segment passes diagonally across work with a *shearing* action that *cuts* and *removes* the metal. Varying contact area insures longer exposure to coolant—decreases heat—reduces segment wear—conserves power.

CORTLAND
Chucks and Segments

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You can now take your pick of hundreds of practical ideas for new products, methods and processes that can make money for your company. To get these ideas for you, the Nation-Wide Bureau of Ideas has scoured the country. The general public is submitting new, useful ideas covering an endless variety of subjects.

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At no cost to you, we will send details of the subscription plan under which your company can benefit from this invaluable source of profit-producing ideas. Send for this information immediately.

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NATION-WIDE BUREAU OF IDEAS
MORTON MANUFACTURING CO.
349 N. Leamington Ave., Chicago 44, Ill.

Fluoborate—no
Sulphamate—no

12. Control of Solution
Cyanide—cyanide and metal
Sulphate—metal and pH
Fluoborate—metal and pH
Sulphamate—metal and pH

The plating of indium on a clean, nonferrous surface does not end the operation; it is merely the deposition of material. For the majority of uses, to secure the full value of the indium deposit, it is essential that the indium be diffused into the base metal. This is done by placing the plated part in an oven, or hot oil bath, and subjecting it to about 2 hr. of heat treating at a point, slightly above the melting point of indium. As indium melts at 155 deg. C. or 311 deg. F. the diffustion should be carried out at about 350 deg. C. (662 deg. F.) This process may be shortened by increasing the temperature, but only after the diffusion has actually begun. Failing to observe the proper temperature at the beginning of the diffusion process may lead to the formation of surface bubbles, which are undesirable, particularly on a decorative finish.

If the base metal itself is capable of being polished and has been properly prepared before indium plating and diffusion, the resulting alloy coating can itself be polished or burnished, particularly with copper, brass, gold and silver. It is important that the operator refrain from using more than a minimum amount of pressure against the burnishing wheel to avoid cutting too deeply into the alloyed surface, which would expose a surface having a different indium content. It is possible to achieve a pleasing surface with light hand buffing.

Indium is being used in dental alloys, jewelry, low melting alloys, solders, brazing materials, and for decorative finishes which are both pleasing in appearance and resistant to corrosive agents. It has been successful as a lubricant for deep drawing dies where it has enhanced the life of such dies many times. Experiments in using indium in the manufacture of abrasive tools hold considerable interest.

•

New Bright Alloy Plating Process

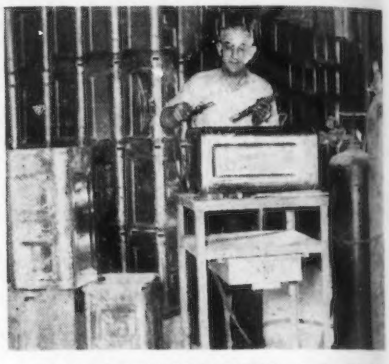
"Bright Alloy Plating," by Myron B. Diggin, Hanson-Van Winkle-Munning Co., and George W. Jernstedt, Westinghouse Electric & Mfg. Co., was one of the outstanding papers of

Welded Galvanized Fabrication Spurred

By GEORGE H. OHMER
Chief Engineer

Dayton

• • • **Taking a tip** from the shipbuilding industry, which has been regalvanizing welds in galvanized sheet, plate and pipe, process engineers quite generally are planning the postwar use of welded galvanized fabrication for products heretofore of riveted or bolted construction.



AMMUNITION BOXES: *Galv-Weld Alloy being applied to skips and burnt areas, saving time and expense of stripping and re-hotdipping.*

Such all-welded design has been made possible by the patented Galv-Weld Process, which, in brief, consists of the coating of the weld and the adjacent damaged area with Galv-Weld Alloy at the time of welding.

Heretofore, welded galvanized structures have been fundamentally unsound from the corrosion standpoint, since the protective galvanizing burned away at the point of and during the process of welding.

Riveted or bolted construction, not as strong or versatile as welded, has been the conventional means of fabricating galvanized steel towers, frames, bases and the like.

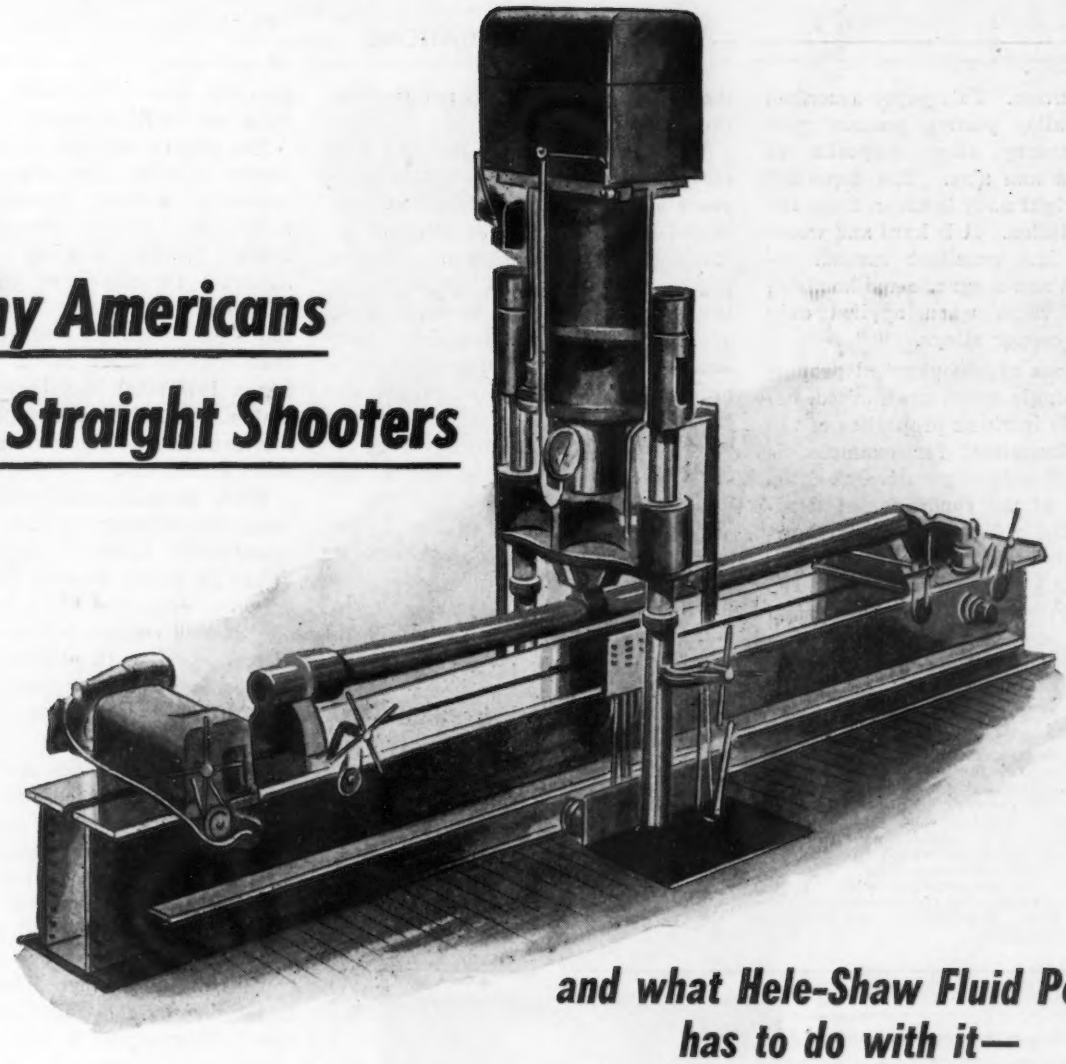
Although in commercial service a short time prior to the war, the Galv-Weld Process first attracted national attention when the thousands of welded joints in merchant and fighting ships were regalvanized and made completely rust and corrosion proof. Galv-Welded joints have withstood more than five years of exposure in salt air mists along the Atlantic seaboard without a failure. Official government laboratory tests have proved Galv-Weld Alloy equal to and/or better than hot dip galvanizing in corrosion resistance.

During one goverment test, Galv-Weld Alloy not only passed the standard salt spray requirement of 200 hours, or about eight days, but remained in test for a period of 141 days without failure.

Readily adaptable to gas, electric and spot welding, the Galv-Weld Process requires no flux in application and gives off no fumes. The alloy, which comes in bar form, may be applied in all positions and in confined quarters. Once applied, the coating will not chip, crack or peel.

Complete details may be had by writing Galv-Weld Products, Dayton 10, Ohio.

Why Americans are Straight Shooters



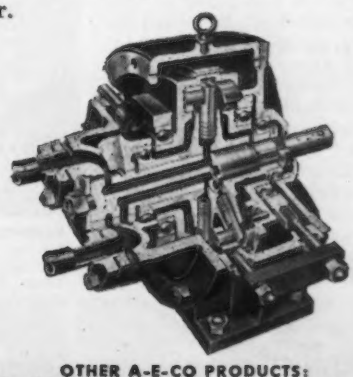
and what Hele-Shaw Fluid Power has to do with it—

GIVE all the credit to the men who do the firing, but reserve an honorable mention for the straight-shooting guns America's ordnance plants turn out. Training and skill in gunnery would be lost were it not for the hair-splitting accuracy of gun barrel straighteners.

The straightener feels the bumps the eye cannot detect over the length and circumference of a gun barrel and irons them out with deadly accuracy under hundreds of tons of pressure.

Pressure in several types of straighteners is generated by a Hele-Shaw Pump and control. Simplicity and ease of control make this a typical application for Hele-Shaw Fluid Power (oil under pressure). Hele-Shaw Fluid Power may be just what you need for pushing, pulling, stretching, squeezing, lifting, tilting, and a variety of comparable mechanical movements. Make sure that in your future developments you use all the possibilities of Hele-Shaw Fluid Power.

THE
Hele-Shaw
Fluid Power Pump



OTHER A-E-CO PRODUCTS:
TAYLOR STOKERS, MARINE DECK AUXILIARIES, LO-HED HOISTS

AMERICAN ENGINEERING COMPANY

2430 ARAMINGO AVENUE • PHILADELPHIA 25, PA

the Convention. This paper described a bright alloy plating process[1] producing ternary alloy desposits of copper, tin and zinc. The deposited alloy is bright as it is taken from the plating solution. It is hard and wear-resistant, has excellent tarnish resistance, is non-magnetic and has high protective value when applied over copper or copper alloys.

Alterations of the physical properties of a single metal are limited, because of the intrinsic properties of the metal. Chromium, for example, is always hard and comparatively brittle, regardless of the conditions of deposition. (The relative hardness, however, can be varied within appreciably wide limits.) The most pronounced changes in chemical and physical properties result from combining two or more metals to produce an alloy, but in the field of electrodeposition, the plating of alloys has not received the attention it merits.

When the corrosion resistance of nickel coatings was investigated some years ago an improved finish was obtained in the form of an alloy of cobalt and nickel. Another alloy plating process in commercial production is the deposition of terne plate, an alloy of lead and tin. Patents have been issued describing the deposition of a bronze alloy composed of copper and tin. Oddly, the color of this alloy is very white and close to silver in reflectivity, even though copper is the major constituent.

In the development of the bright alloy process, several variations were made from the standard cyanide bath in order to make the plating range sufficiently flexible for plating room control.

The bright alloy process produces deposits composed of copper, tin and zinc. The deposition of such an alloy is not new, but the present process is novel in that anodes of the same composition as the deposits have been perfected, thus automatically maintaining the metal concentration of the bath. Another desirable characteristic of this process is that deposits are a pleasing blue-white color and come from the solution bright.

The plating solution is composed of copper cyanide, zinc cyanide, sodium stannate, sodium cyanide, sodium hydroxide, and an organic addition agent having wetting properties. Separate formulae are provided for still and barrel plating. In either case the total metal concentration is less than one ounce per gallon. Maintaining a low total metal concentration makes the solution inexpensive and less sensitive to fluctuations in operation conditions.

With normal anode-cathode spacings, the voltage in still plating is maintained between 3½ and 4½ volts; in barrel plating from 5 to 6 volts are employed. The current density at this voltage is between 10 and 15 amp. per sq. ft. Under these conditions it requires approximately 30 min. to produce a deposit 0.0002 in. thick.

When a tank is completely loaded, the deposits produced are uniformly bright. With anodes much longer than the work being plated, or where a tank is only partially loaded, masks or "thieves" are required to prevent fogging at abnormally high current density areas. The anode area should consist of 85 per cent insoluble material such as cold-rolled steel or carbon. Alloy anodes in steel containers serve as the remaining 15 per cent area. With this ratio of insoluble anode area, the bath remains fairly stable in respect to the three metal constituents. At this ratio the anode efficiency is nearly 100 per cent, and in general little difficulty will be experienced with anode corrosion if the pH is maintained between 12.6 and 13.0 (electrometric with the type "E" glass electrode) and if the anodes are of suitable composition and structure.

The temperature of the alloy bath is maintained at approximately 145 deg. F. by steel steam coils. In barrel solutions the most favorable temperature range is 150 deg to 160 deg. F. The composition of the alloy deposit is approximately as follows:

	Per Cent
Copper	56
Tin	28
Zinc	16

There is little difficulty in consistently depositing the three metals in the proportions given with temperature control and with the solution in proper balance chemically.

The addition agent has strong "wetting" or surface tension-lowering qualities. Because of this, it is important to rinse plated work well to

[1] The process was developed by the Westinghouse Electric & Mfg. Co., Meter Division, Newark, for applications where existing single metal or binary deposits could not meet severe military requirements. The co-author of this paper, G. W. Jernstedt, did a major share of the investigational work on which the process is based. The Hanson-Van Winkle-Munning Co. is cooperating with Westinghouse in introducing the process to the plating industry. Patents on the process are now pending.

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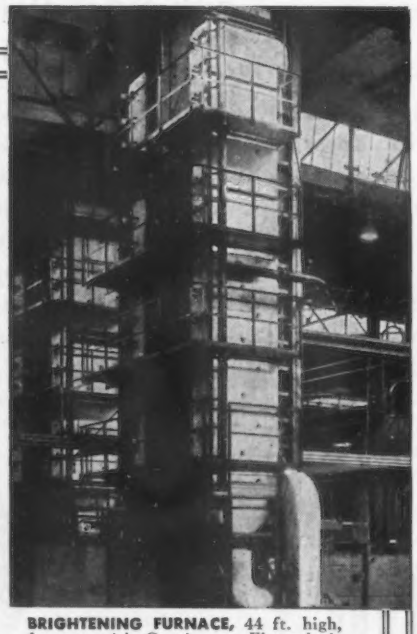
for precision in Heavy Plate and Sheet Steel Work

Here is an 8½ acre plant . . . with the most modern equipment for shearing, rolling, forming, welding and completely fabricating ferrous, non-ferrous and alloy metals to your specifications . . . from the lightest gauge up to and including 1¼" mild steel or ¾" armor plate. Extensive war contracts necessarily limit our present acceptance of new business for immediate delivery. Address: Charles T. Brandt, Inc., Baltimore-30, Md.



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BRANDT of Baltimore—*Craftsmen in Metal Since 1890*

The Greatest American Legend...

He's a man without a last name . . . a fellow known to every American kid as "Uncle." He is everywhere in his great land—yet no one has ever seen him. He is the great spirit of America . . . calm, quiet, peaceful and kindly until he gets his "dander" up—then he is determined, strong and his wrath is relentless.

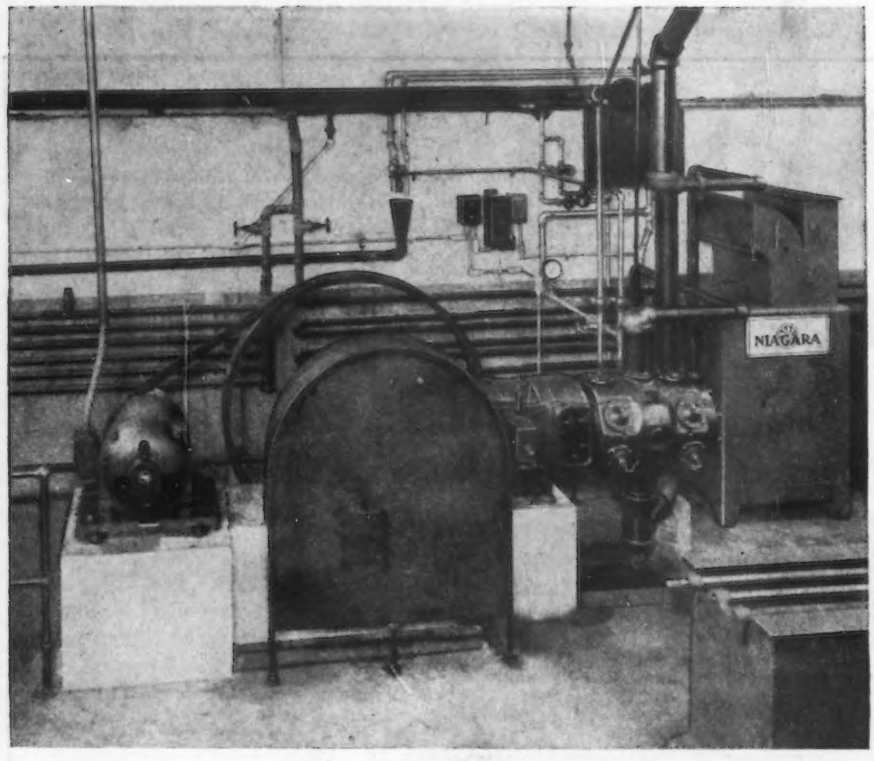
His is the spirit of sacrifice, toil and patriotism. He has weathered many wars, trials and tribulations—yet he is indomitable. He stood with Washington at Valley Forge . . . Perry at Lake Erie . . . Lincoln at Gettysburg . . . Pershing at the Marne . . . MacArthur at Bataan. He stands with every American to defend America.

Today, he stands with you . . . urging you to do more and more in the cause of Victory. To buy more War Bonds—to contribute to the blood bank—to stamp out Black Markets—to defeat inflation—to be untiring in your efforts to hasten the day when our enemies will fall before our might. Ask yourself squarely if you couldn't be doing *more* to aid this great spirit—then *do* it.

Let's keep this *greatest* American legend . . . *GREAT!*

APEX

THE APEX MACHINE AND TOOL COMPANY • DAYTON 2, OHIO



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● The moisture that is condensed from compressed air is the chief source of trouble with air lines, tools and equipment. It may freeze in the lines; it may rust or damage products exposed to the air stream; it washes the lubricants out of your tools and causes rusting and more rapid wearing out of parts, especially in rotary tools.

To protect this equipment, take the excess moisture out of compressed air by using the NIAGARA *AERO* AFTER-COOLER. It produces lower compressed air temperatures and the resulting air contains only one-half to three-fourths as much moisture as air cooled by conventional methods. Because it is an evaporative cooler, it uses atmospheric air as the cooling medium and pays for itself by saving water costs.

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INDUSTRIAL COOLING • HEATING • DRYING
HUMIDIFYING • AIR ENGINEERING EQUIPMENT

remove the addition agent before drying, especially in assemblies where solution tends to remain because of capillarity.

Nickel, silver, copper and many other metals can be plated over or under the alloy deposit. Chromium can be applied directly over the alloy deposit but the work should be given a light anodic cleaning to remove the film remaining because of the presence of the wetting agent. In barrel installations where a higher cyanide content is maintained there should be no delay in rinsing, as a slight discoloration of the plated surface may occur. A rinse tank should be placed temptingly close to the barrel apparatus. Rapid methods have been developed for the analysis of all bath constituents.

The outstanding property of this bright alloy coating is its corrosion resistance. On brass or copper base metals, it is possible to pass the 200-hr. salt spray test with a thickness of only 0.0002 in.

The alloy is relatively brittle when deposited to obtain heavy coatings; however, it is seldom used in thicknesses over 0.0002 in. Its hardness is greater than that of nickel and its wear resistance is superior to normal nickel deposits. Coatings of 0.0002 in. of alloy plating give approximately the same reading on a Tabor Tester as 0.0005 in. of nickel from a low temperature Watts solution.

The bright alloy process has high throwing power; the addition agent being an important factor in securing this property.

When it is desired to provide a mirror-like surface, the alloy deposit can be colored more readily than nickel. The actual reflectivity obviously approaches silver (80 to 85 per cent) since its composition is almost that of the cast and polished Speculum alloy mirror.

The bright alloy plating process is not recommended for application directly on steel, where the prime requisite is corrosion protection; it is much more advantageous to apply a copper undercoating and secure the benefits of low corrosion rates between the bright alloy and the copper.

Ed. Note: Next week this report will be concluded with discussions on hard chrome problems, electroforming techniques, colored anodic coatings on aluminum, and new coatings for zinc.

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There is no substitute for active metal in producing welding current. That is why this P&H welder out-performs other welding machines. Compare its weight, its range, its operating advantages — on a dollar and cents basis.

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(Welding Service Range)
RATINGS
BASED ON ACTUAL DELIVERED OUTPUT OF USABLE WELDING CURRENT

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Here is a machine in a class by itself, designed to serve the widest possible range of applications in general welding practice. It's an "in-between" capacity that overlaps the ability of smaller and larger machines. It's a standout in performance — and value!

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MACHINE TOOLS

. . . News and Market Activities

WPB Redistribution Plan Criticized

Cleveland

• • • **Considerable criticism** is being leveled at the WPB machine tool redistribution program in many centers because it is not functioning very efficiently, according to reports, and represents a duplication of work which is looked upon as unnecessary by many.

In effect, the WPB activities in this line appear to be a poor duplication of military service activities, operating in an ineffectual manner due to late and insufficient information on surplus tools. Sterner critics believe that the WPB could be removed from the scene without loss. Certain individuals of the WPB itself have admitted that its records of surplus machine tools are incomplete and often obsolete so far as the services' tools are concerned.

Briefly, the formula followed by the services with regard to machine tools is to individually check plants when contracts are terminated or altered and actually list the machines thrown into idleness instead of awaiting a contractor's report. For a period of 20 days the particular branch of service holds this listing and attempts to relocate the machine tools in service. This generally results in a transfer of the machines to another service whose contract is coming into the plant or has requested assistance.

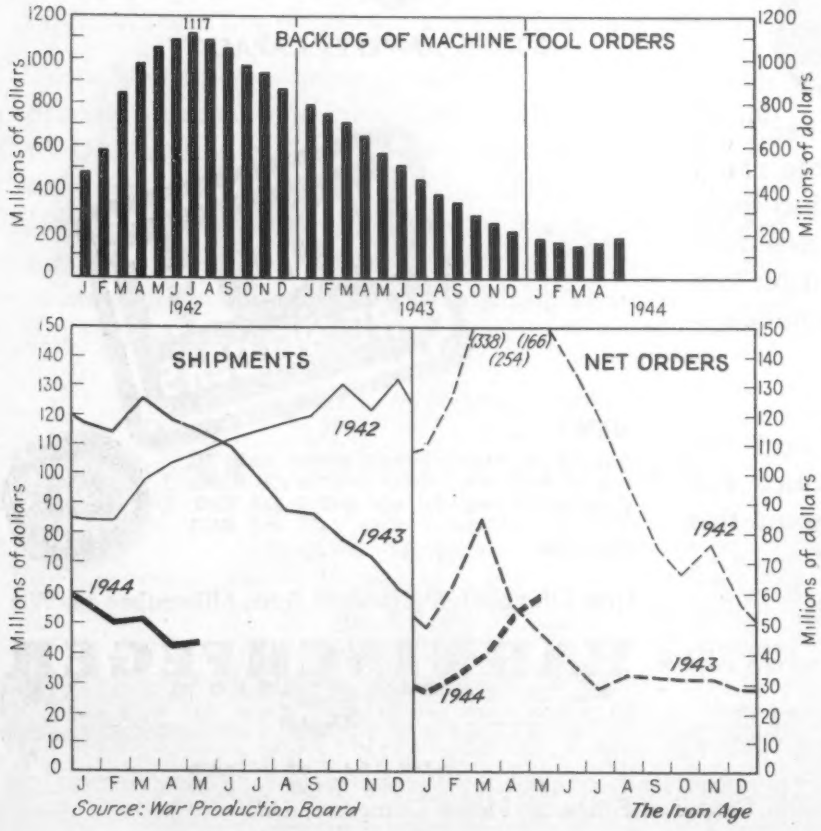
If any machine tools are left after this procedure, the listings are sent to Washington where they are circularized for 40 days for the benefit of all services including the WPB. If there are still tools remaining, the listings go to RFC as true surpluses but remain on WPB lists. The selection, by this time, is at its poorest.

The foregoing is at least the military procedure. What more frequently happens, according to some prime contractors, is that machine tools thrown out of service by a cutback or termination are generally usable on another contract immediately entering the shop and are never reported officially. The services have been very quick to permit the transfer of such machines to the use of the new procurement agency entering the plant which keeps the tools off the surplus listings entirely.

Transfers of this type have been so heavy that one branch of service is known to be buying new machines because of having transferred too many to other services under these conditions. The flow of idle machines between services has been very free and efficient according to many observers who also indicate that this method is sufficient without WPB duplication of effort. Some of the same observers believe that WPB should act only as an outlet for idle tools which have been officially lodged with RFC as surplus and do a thorough job there rather than attempt to duplicate what each service is set up to handle individually.

Despite criticism of WPB's activity in this line, there is reason for WPB's existence in the case. WPB is the only source through which any attempt to coordinate all idle tools has been made. The services have undoubtedly done a meritorious job individually but have not had the means of coordinating information except through the Washington listing. Using this information, tardy as it is, the WPB has attempted to utilize its many offices to share the information. It is natural that WPB should groan at the lack of a pool of idle tools from which all could draw at approximately the same time but the services have saved much time by transferring tools before registration was ever necessary. Each appears to have its duties and limitations. Stern criticism does not seem in order.

• • • Reflecting the increased demand for machine tools as the result of recent new military programs, net new orders for machine tools in May exceeded shipments for the second time since August, 1942. New orders less cancellations in May were valued at $59,852,000, an increase of 8.3 per cent over the April total of $55,247,000, according to the WPB. May cancellations amounted to $1,342,000, as compared with $2,330,000 in April. Shipments for May on the other hand, at $41,712,000, showed an increase of less than 1 per cent over the April figure of $41,370,000. As a result, the backlog of unfilled orders climbed for the second month. At the end of May, the backlog was valued at $186,343,000, an increase of 11.4 per cent over the April total of $167,232,000. At the May rate of shipments, the May backlog represents four and a half months' orders.



Source: War Production Board — The Iron Age

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ARMY E NAVY

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NON-FERROUS METALS

. . . News and Market Activities

Copper Supply Balances Demand in 1943

• • • **By January, 1944,** the position of copper had changed from a material whose supply was insufficient for essential needs to one which was in approximate balance according to the Bureau of Mines. But little metal was available for easing the limitations on consumption for other than war and the most essential civilian purposes. There was a tendency in the last months of the year and early in 1944 to withdraw some of the limitations on the use of copper and copper alloys. In the main the relaxations affected only highly essential civilian goods where the use of copper provided a saving in manpower or where the use of substitute materials had proved impractical. In no case are the relaxations believed to have involved substantial tonnages.

The easier situation in the last quarter of 1943 was due in large part to the cutbacks in the small-arms ammunition program. The program for substitution on a substantial scale of steel for brass in cartridge case manufacture was largely abandoned at the end of 1943 after brass capacities had been materially increased. The Army released 3200 men to copper mines in 1943, compared with 2300 in 1942, in an endeavor to cope quickly with labor inadequacies. The numbers released were insufficient to offset the shift in labor away from mines, partly for jobs that appeared to have a closer relationship to the war and partly for military service. Larger production in 1943 was possible, therefore, only because of the operation of the greater capacities at Morenci and Bagdad, Ariz., the starting of production at properties such as the Castle Dome, Ariz.; Gray Eagle, Calif.; the new tailings mill at Quincy, Mich.; the Big Indian, Utah; Elizabeth, Vermont, and others.

Mine, smelter and refinery outputs from domestic ores in 1943 were at peak rates. In relation to the previous war period, 1916-18, and to the period of great industrial activity, 1925-1929, the record is even more impressive. During these periods the quoted prices at New York averaged as follows: 1916-18, over 27c.; 1925-29, nearly 15c.; and 1942-43, 11.87½c. Bonus payments improved the 1942-43 average from the points of view of some producers, of course, but they did not apply to as much as 10 per cent of the 1942 output, nor to ¼ of that for 1943.

Production of refined copper from foreign crude materials declined 15 per cent in 1943 but receipts of refined metal were at peak. Exports of copper as metal and in primary manufactures were above the rates established in 1941 and 1942.

Mercury Production and Consumption in the United States in Flasks of 76 pounds each

PERIOD	Production	Consumption	Stocks at End of Period		Price Per Flask at New York
			Consumers and Dealers[1]	Producers[2]	
	Average Monthly				
1939	1,553	1,742[3]	12,600	376	$103.94
1940	3,148	2,233	14,100	607	176.87
1941	3,743	3,733	12,400	439	185.02
1942	4,237	4,142	10,700	1,377	196.35
1943	4,327[4]	4,542	13,200	3,457	195.21
	Monthly				
1944:					
January	4,400	3,400	11,300	5,459	151.60
February	3,800	3,700	9,400	5,450	130.00
March	3,800	3,600	9,900	5,011	130.00
April	3,700	3,200	9,700	5,604	128.20
May	3,400	3,100	8,900	6,171	115.54

[1] Largely excludes redistilled metal. [2] Held by reporting companies. [3] Apparent consumption. [4] Based on final figures.

•

Brass for Blow Torch Tanks

• • • **The importance of** the blow torch to war production programs, WPB officials told the Blow Torch Industry Advisory Committee recently, is such as to permit the relaxation of restrictions to make brass available for blow torch tanks.

Further action in widening the use of brass for this purpose awaits more definite data from the blow torch industry, WPB officials said.

•

Magnesium

• • • **Primary magnesium** production in April dropped to 37,846,000 lb.—8 per cent below the peak reached in the first quarter of 1944—according to data released by the Aluminum and Magnesium Division, WPB. This decrease reflects the government-ordered curtailment in the magnesium metal program. Secondary recovery amounted to 2,272,000 lb.

Magnesium sand castings reached a high for the war in March when 7,574,000 lb. were shipped, but fell by almost 9 per cent in April to 6,918,000 lb. April shipments of magnesium die castings totalling 185,000 lb. rose 8 per cent over March. Magnesium sheet, strip and plate shipments rose substantially to 309,000 lb. in April which was more than 70 per cent greater than in January, and 140 per cent greater than in April, 1943. Magnesium forgings increased by 62½ per cent in April to 52,000 lb. Extrusions dropped by 23 per cent to 140,000. These figures do not include production of incendiary bomb castings, extruded sheet stock and forging stock, or sticks.

•

Mercury

• • • **Mercury production** continued to decline in May and consumption followed a like pattern, according to the Bureau of Mines. The production of 3400 flasks marked a drop of 23 per cent from the January rate. The quoted price dropped 10 per cent in May continuing the movement in progress since September, 1943.

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To more effectively serve the welding industry, Ransome has established a new sales policy of direct distribution by local Welding Equipment Distributors throughout the United States.
For your future Positioning Equipment requirements, it will pay you to investigate the exceptionally complete Ransome line. Write us for complete information. We will supply it with the name of a nearby Ransome distributor.
Attention!
WELDING SUPPLY DISTRIBUTORS
Write us for full information on what this new sales policy can do for you!
INDUSTRIAL DIVISION
Ransome MACHINERY COMPANY
DUNELLEN, NEW JERSEY
SUBSIDIARY OF WORTHINGTON PUMP AND MACHINERY CORPORATION

REFINER, SMELTER PRICES

(Cents per lb. unless otherwise noted)

Aluminum, 99+%, del'd	15.00
Aluminum, No. 12 Fdy., (No. 2)	12.00
Aluminum, deoxidizing grades	11.00 to 12.25
Antimony, Asiatic, New York	Nominal
Antimony, American, f.o.b. Laredo, Tex.	14.50
Arsenic, prime white, 99%	4.00
Brass, 85-5-5-5 ingots (No. 115)	13.00
Cadmium, del'd	90.00
Cobalt, 97-99% (dollars per lb.)	$2.11
Copper, electro, Conn. Valley	12.00
Copper, electro, New York	11.75
Copper, lake	12.00
Copper, beryllium, 3.75-4.25% Be; dollars per lb. contained Be	$15.00
Gold, U. S. Treas., dollars per oz.	$35.00
Indium, 99.5%, dollars per troy oz.	$7.50
Iridium, dollars per troy oz.	$165.00
Lead, St. Louis	6.35
Lead, New York	6.50
Magnesium, 99.9+%, carlots	20.50
Magnesium, 12-in. sticks, carlots	30.00
Mercury, dollars per 76-lb. flask, f.o.b. shipping point or port of entry	$191 to $193.00
Nickel, electro	35.00
Palladium, dollars per troy oz.	$24.00
Platinum, dollars per oz.	$35.00
Silver, open market, New York, cents per oz.	44.75
Tin, Straits, New York	52.00
Zinc, East St. Louis	8.25
Zinc, New York	8.67

Copper, Copper Base Alloys

(Mill base, cents per lb.)

	Extruded Shapes	Rods	Sheets
Copper	20.87	....	20.87
Copper, H.R.	....	17.37	....
Copper, drawn	....	18.37	....
Low brass, 80%	....	20.40	20.15
High brass	....	....	19.48
Red brass, 85%	....	20.61	20.36
Naval brass	20.37	19.12	24.50
Brass, free cut	....	15.01	....
Commercial bronze, 90%	....	21.32	21.07
Commercial bronze, 95%	....	21.53	21.28
Manganese bronze	24.00	....	28.00
Phos. bronze, A, B, 5%	....	36.50	36.25
Muntz metal	20.12	18.87	22.75
Everdur, Herculoy, Olympic or equal	....	25.50	26.00
Nickel silver, 5%	....	28.75	26.50
Architect bronze	19.12	....	....

Aluminum

(Cents per lb., subject to extras on gage, size, temper, finish, factor number, etc.)

Tubing: 2 in. O.D. x 0.065 in. wall 2S, 40c. (½H); 52S, 61c. (O); 24S, 67½c. (T).

Plate: 0.250 in. and heavier; 2S and 3S, 21.2c.; 52S, 24.2c.; 61S, 22.8c.; 24S, 24.2c.

Flat Sheet: 0.188 in. thickness; 2S and 3S, 22.7c. a lb.; 52S, 26.2c.; 61S, 24.7c.; 24S, 26.7c.

2000-lb. base for tubing; 30,000-lb. base for plate, flat stock.

Extruded Shapes: "As extruded" temper; 2000-lb. base, 2S and 3S, factor No. 1 to 4, 25.5c.; 14S, factor No. 1 to 4, 35c.; 17S, factor No. 1 to 4, 31c.; 24S, factor No. 1 to 4, 34c.; 53S, factor No. 1 to 4, 28c.; 61S, factor No. 1 to 4, 28½c.

The factor is determined by dividing perimeter of shape by weight per lineal foot.

Wire Rod and Bar: Base price; 17ST and 11ST-3, screw machine stock. Rounds: ¼ in., 28½c. per lb.; ½ in., 26c.; 1 in., 24½c.; 2 in., 23c. Hexagonals: ¼ in., 34½c. per lb.; ½ in., 28½c.; 1 in., 25½c.; 2 in., 25½c. 2S, as fabricated, random or standard lengths, ¼ in., 24c. per lb.; ½ in., 25c.; 1 in., 24c.; 2 in., 23c. 24ST, rectangles and squares, random or standard lengths, 0.093-0.187 in. thick by 1.001-2.000 in. wide, 33c. per lb.; 0.751-1.500 in. thick by 2.001-4.000 in. wide, 29c.; 1.501-2.000 in. thick by 4.001-6.000 in. wide, 27½c.

Magnesium

Sheet, rod, tubes, bars, extruded shapes subject to individual quotations. Metal turnings: 100 lb. or more, 46c. a lb.; 25 to 90 lb., 56c.; less than 25 lb., 66c.

NON-FERROUS SCRAP METAL QUOTATIONS

(OPA basic maximum prices, cents per lb., f.o.b. point of shipment, subject to quality, quantity and special preparation premiums)

Copper, Copper Base Alloys

OPA Group 1

No. 1 wire, No. 1 heavy copper	9.75
No. 1 tinned copper wire, No. 1 tinned heavy copper	9.75
No. 2 wire, mixed heavy copper	8.75
Copper tuyeres	8.75
Light copper	7.75
Copper borings	9.75
No. 2 copper borings	8.75
Lead covered copper wire, cable	6.00*
Lead covered telephone, power cable	6.04
Insulated copper	5.10*

OPA Group 2

Bell metal	15.50
High grade bronze gears	13.25
High grade bronze solids	11.50*
Low lead bronze borings	11.50*
Babbitt lined brass bushings	13.00
High lead bronze solids	10.00*
High lead bronze borings	10.00*
Red trolley wheels	10.75
Tinny (phosphor bronze) borings	10.50
Tinny (phosphor bronze) solids	10.50
Copper-nickel solids and borings	9.25
Bronze paper mill wire cloth	9.50
Aluminum bronze solids	9.00
Soft red brass (No. 1 composition)	9.00
Soft red brass borings (No. 1)	9.00
Gilding metal turnings	8.50
Contaminated gilded metal solids	8.50
Unlined standard red car boxes	8.25
Lined standard red car boxes	7.75
Cocks and faucets	7.75
Mixed brass screens	7.75
Red brass breakage	7.50
Old nickel silver solids, borings	6.25
Copper lead solids, borings	6.25
Yellow brass castings	6.25

OPA Group 3

Yellow brass soft sheet clippings	8.625
Yellow rod brass turnings	8.375
Zincy bronze borings	8.00
Zincy bronze solids	8.00
Fired rifle shells	8.25
Brass pipe	7.50
Old rolled brass	7.00
Admiralty condenser tubes	7.50
Muntz metal condenser tubes	7.00
Plated brass sheet, pipe reflectors	6.50
Manganese bronze solids	7.25[1]
Manganese bronze solids	6.25[2]
Manganese bronze borings	6.50[1]
Manganese bronze borings	5.50[2]

OPA Group 4

Automobile radiators	7.00

OPA Group 5

Refinery brass	5.00*

*Price varies with analysis. [1] Lead content 0.00 to 0.40 per cent. [2] Lead content 0.41 to 1.00 per cent.

Other Copper Alloys

Briquetted Cartridge Brass Turnings	8.625
Cartridge Brass Turnings, Loose	7.875
Loose Yellow Brass Trimmings	7.875

Aluminum

Plant scrap, segregated

All S-type alloys (except 2S)	8.50
2S solids	8.00
High grade alloys	7.00
Low grade alloys	6.50
Borings and turnings	
High grade alloys	5.50
Low grade alloys	5.00

Plant scrap, mixed

All solids	6.00
Borings and turnings	4.00

Obsolete scrap

Pure cable	8.00
Old sheet and utensils	7.00
Old castings and forgings	6.50
Pistons, free of struts	6.50
Pistons, with struts	4.50
Old alloy sheet	5.50

For old castings and forgings, pistons, sheets, add ½c. lb. for lots 1000 to 19,999 lb.; for other scrap add 1c.; for lots over 19,999 lb. add 1½c. a lb.

Magnesium

Segregated plant scrap

Pure solids and all other solids, exempt	
Boring and turnings	8.00

Mixed, contaminated plant scrap

Grade 1 solids	11.00
Grade 1 borings and turnings	7.00
Grade 2 solids	9.00
Grade 2 borings and turnings	5.00

For lots over 1499 lb. add 1c. per lb.

Zinc

New zinc clippings, trimmings	7.25
Engravers' lithographers plates	7.25
Old zinc scrap	5.75
Unsweated zinc dross	5.80
Die cast slab	5.80
New die cast scrap	4.95
Radiator grilles, old and new	4.95
Old die cast scrap	4.50

Lead

Deduct 0.55c. a lb. from refined metal basing point prices or soft and hard lead inc. cable, for f.o.b. point of shipment price.

Nickel

Ni content 98+%, Cu under ½%, 26c. per lb.; 90 to 98% Ni, 26c. per lb. contained Ni.

ELECTROPLATING ANODES AND CHEMICALS

Anodes

(Cents per lb., f.o.b. shipping point)

Copper: Cast, elliptical, 15 in. and longer	25⅛
Electrolytic, full size	22⅞
cut to size	30⅛
Rolled, oval, straight, 15 in. and longer	23¼
Curved	24¼
Brass: Cast, 82-20, elliptical, 15 in. and longer	23⅝
Zinc: Cast, 99.99, 16 in. and over	16¼
Nickel: 99% plus, cast	47
Rolled, depolarized	48
Silver: Rolled, 999 fine per Troy (1-9) oz., per oz.	58

Chemicals

(Cents per lb., delivery from New York)

Copper cyanide, tech., 100-lb. bbls. 1-5	5.65
Copper sulphate, 99.5 crystals, bbls.	13.00–13.50
Nickel salts, single, 425-lb. bbls.	34.00
Silver cyanide, 100 oz., lots	40.82–41.125
Sodium cyanide, 96% dom., 100-lb. dms.	0.15
Zinc cyanide, 100-lb. dms.	33.00
Zinc, sulphate, 89% crystals, bbls.	6.80

CORRECT Lubrication means *Better Maintenance*

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SOLUTION—*Correct* lubrication.

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SCRAP

. . . News and Market Activities

C-I Challenges Scrap Regulations

Chicago

• • • **Taking advantage of** provisions of the amended Price Control Act recently passed by congress, Carnegie-Illinois Steel Corp. has challenged in Federal Court an OPA order entered June 29 enjoining it from violating OPA scrap regulations.

The OPA had charged the company with purchasing material as electric furnace scrap and later using it in its open hearth furnaces, in violation of OPA regulations. In its petition, the company stated that the scrap was found to be unsuited for electric furnace use in the production of steel carrying rigid specifications. However, the petition continued, the company substituted mill scrap in an equivalent amount for the electric furnace requirements and used the unsuitable scrap in its open hearth. The company further charged that the regulation, which attempts to prohibit the use of electric furnace grades of scrap in open hearth furnaces, is illegal and void.

Under the new Price Control Act, defendants in criminal or civil proceedings may appeal for leave to file objections in the Emergency Court of Appeals within five days after a judgment has been rendered. Hearing on the company's petition will be held July 20.

Scrap Prices

• • • **Revisions of the scrap price schedules will appear in** The Iron Age, **July 20, with all changes made under the recent revisions by the Office of Price Administration.**

Additional Details on OPA Revised Steel Scrap Schedule

Washington

• • • **In addition to the** major changes embraced in the revised price schedule for iron and steel scrap recently issued by OPA as Maximum Price Regulation No. 4, grades of scrap for which the regulation establishes basing point prices, where previously they had been priced by letter, include welding rod butts, shafting No. 1 railroad cast steel, and wrought iron.

The regulation establishes for prepared wrought iron scrap a price of $6.50 per gross ton above the dealer No. 1 heavy melting steel base price. The fee for cutting rails to lengths of 18 in. or under is increased from $2.50 to $3.25 per gross ton. This increase has been accomplished by reducing the price of scrap rails in random lengths and rails 3 ft. in length 50c. and increasing the price of rails 18 in. in length, 25c. The fee for cutting rails to 3 ft. lengths remains the same, because the 50c. reduction in price applies both to scrap rails and rails 3 ft. in length. The grade of rails 2 ft. in length has been eliminated.

The regulation combines two sections of RPS 4 which dealt separately with cast iron of dealer and industrial origin and with that of railroad origin. Ten grades of cast iron now cover all those previously contained in the two sections. The prices established by this new section for the various grades of cast iron scrap in this section apply to all sellers, regardless of the origin of the material.

The regulation eliminates the former dual basing point system under which 25 basing points covered railroad scrap and 38 covered dealer and industrial scrap. The former railroad scrap basing points have been eliminated and the previous 38 dealer and industrial scrap basing points now cover all scrap regardless of origin. There were also several other changes made by the regulation.

METAL SAVER: *A workman drags small crushed metal chips, shavings, turnings and borings into a centrifugal wringer which will free them of oil and grease at the Curtiss Wright Corp. plant at Columbus, Ohio. Process is part of plant's metal salvage program.*

No. 2 Differential In Prices Believed Sought

• • • **There appears to** be a move in some quarters to obtain a price differential between No. 1 and No. 2 heavy melting iron and steel scrap. While this has not reached the point of being a concerted action among the scrap consumers, there is evidence in local areas that such is the case.

With mills being particularly inventory conscious, rejecting numerous shipments because they are off specification, and generally being quite touchy about their scrap requirements and acceptances, there have been very few instances when heavier grades of scrap were not needed. Now, however, even that picture is changing, and many mills are placing embargoes on scrap shipments until stocks are worked off. If they succeed in breaking the price on No. 2, there is every possibility of a widespread breakdown of prices of other grades of scrap.

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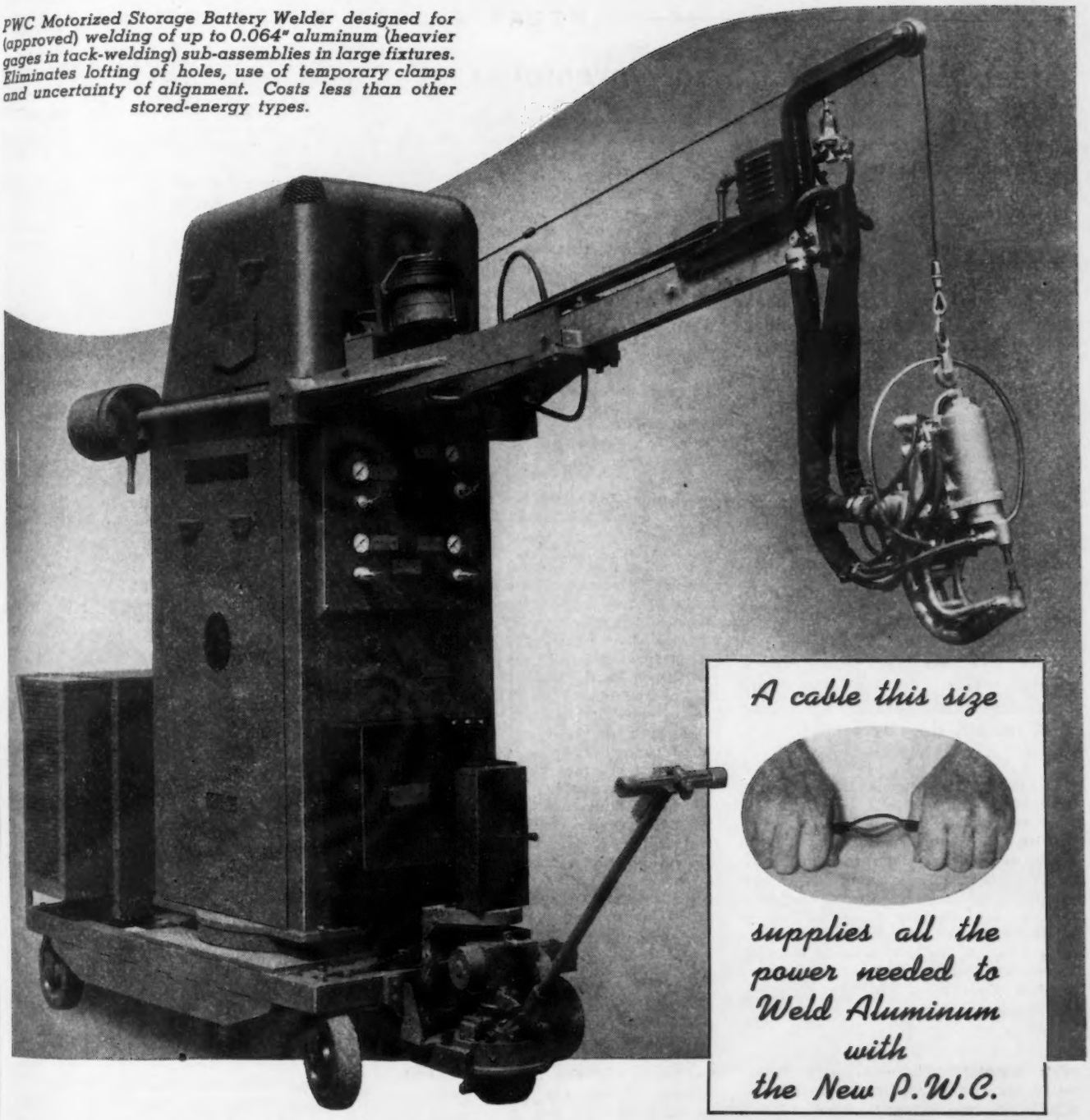

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WHY STORAGE BATTERY WELDING: The idea of using batteries for welding is old but was not practical heretofore. It was made possible by the new PWC contactor, which reduces welding current to practically "zero" from 1000s of amperes just prior to interruption, (eliminates arcing). Simple sliding rheostat adjusts welding current. Adjustment is less critical than with other types of welders.

STORAGE BATTERY WELDING IS SUITABLE FOR: any form of resistance welding, (gun welders, pedestal welders, projection, seam and butt welders). Ask for Pictorial No. 37.

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Steel Mills Restrict Scrap Inventories

• • • **Except in the Buffalo area, where heavy barge shipments are being received from New York City, the market is dull. Steel mills are reluctant to take on inventories of scrap beyond their day to day needs in the belief that the progress of the war in the immediate future may clarify the scrap price structure. Manpower shortage in the yards, and unwillingness to be caught with heavy inventories in a price drop, are acting to prevent the establishment of a backlog of scrap supplies. Some concern has been expressed about the possibility of a shortage this winter.**

Prices of heavy melting stock are firm despite the inactive market. Mills are adhering rigidly to specifications, however, and there is a tendency for dealers to sacrifice price to a limited extent in shipping to mills that are more liberal in acceptance of shipments.

Steel turnings are selling below ceiling prices. In the New York area, mixed alloy turnings are selling at $5 per ton, shipping point.

•

PITTSBURGH—Buyers here are still selective as far as No. 1 heavy melting steel scrap is concerned. No. 2 heavy melting and bundles are not in such heavy demand and the poor showing in the movement of alloy turnings is still evident. The water rate on machine shop turnings for shipment from the East to Pittsburgh is being ignored. Short shoveling turnings are still in good demand. Buyers continue to control the amount of their inventories, and are tough on specifications.

•

BOSTON—With a surplus of materials mills demand price concessions. Shipments via rail have dropped to proportions hardly warranting the market being termed as such. Material suitable for foundry consumption is progressively harder to pick up, say brokers. Direct sales by yards cut down brokerage transactions.

•

NEW YORK — Basic open hearth grades are firm although mills are said to be increasingly particular as to quality. Prices of turnings and borings are relatively weak as demand continues very low in the face of increasing supplies. Mixed alloy turnings are selling at $5 per ton, shipping point. While most shipments from the metropolitan area go by barge to Buffalo, it is reported that certain dealers and yards are sacrificing about 16c. per ton in shipping to Pittsburgh rather than hazard rejections by mills that are holding rigidly to grade specifications.

•

PHILADELPHIA—Most mills in this area are currently out of the market, with shipments going forward only on old orders. New orders are not coming in. This condition exists across the board for practically all types of scrap, including the heavier grades of open hearth material. Inventories at mills seem to be quite satisfactory, and some mills indicate that they will probably be out of the market for the next three or four weeks.

•

BUFFALO — All items except steel turnings are reported moving steadily from dealers' yards. Sales of turnings are reported at $13 although the chief consumer is seeking offers at $12.50. While local scrap production remains fair, barge canal shipments from New York City continue heavy, five fleets of barges arriving within a few days and unloading 15,000 tons for local mills. More fleets are reported in transit.

•

CLEVELAND — The market here is very selective and moderately quiet. Most mills are holding inventories as low as feasible but heavy production maintains a slow flow of scrap in most grades. Blast furnace is still most active of the lot. Open hearth scrap is moving to the Valley and Pittsburgh. The yards are reported well supplied but are so short of manpower that preparation is lagging. More concern about a possible impending scrap shortage this winter is being shown but heavy backlogs of scrap are not being built to offset this possibility. Should the war continue through September, renewed salvage activities are expected, but little hope for flushing out large supplies of scrap can be held. July is expected to be a low month for the Cleveland market.

•

CINCINNATI — The scrap market in the Southern Ohio District remains quiet. Mills generally are reported to be in good inventory and because of this there appears to be some reluctance on the part of consumers to purchase materials. Good cast and rail is, however, still in demand. Prices are holding at ceiling levels.

•

BIRMINGHAM — A dull market for open hearth grades in this area was further depressed by a strike of open hearth workers which halted ingot production for five days at the Gadsden, Ala., operations of Republic Steel Corp. Market uncertainty and manpower problems have forced dealers to reduce their purchase price for unprepared scrap. Sixty days ago dealers were paying for mixed yard scrap 15 to 20 cents more per hundred pounds than is being paid at present.

•

SAN FRANCISCO—Columbia Steel Co. at Pittsburg and Torrance, Cal., is currently purchasing No. 1 melting scrap for $15.58 and No. 2 grade and dealer's bundles for $14.58. Scrap supply on the West Coast continues comfortable and inventories are increasing. Shipments on allocation of government-owned shipyard scrap continue to midwest mills and no substantial West Coast buyers have recently applied for WPB allocations.

•

CHICAGO—Shoveling turnings are being shipped outside of Chicago within a dollar or so of the $15.75 ceiling price. Meanwhile the offering of $13.75 for this blast furnace grade, $2 below ceiling, continues within Chicago. Although there is very little activity in the light of the higher out-of-town bid, there is no indication at this time that the local price will strengthen immediately. Cast iron continues tight. Demand for open hearth grades remains steady, holding prices firmly at ceiling levels. The 4100 series alloy steel scrap now is moving without extras in common with other alloy grades.

•

ST. LOUIS—Although the hot weather and the shortage of men to handle scrap iron in the country have held down shipments of scrap iron to the St. Louis industrial district, mills have comfortable inventories.

Delivery of Iron Ore; Fleet Capacity Balanced

Washington

• • • **WPB officials at** a recent meeting of the Iron and Steel Transportation Committee reported that delivery of iron ore through the Great Lakes and capacity of fleets appeared to be in balance with the season's requirements. Shipments as of June 26 were reported to be 27,000,218 gross tons as compared with 23,661,800 tons reported in the corresponding week of 1943.

Present motor truck production and a scarcity of tires of larger size were declared to be of particular concern to the industry at this time in the movement of steel products. A WPB official said that the total production of trucks scheduled for this year, including those for military purposes, is approximately 1,000,000 of which an estimated 123,000 are for non-military governmental and civilian use.

Need 1,350,000 Tons Steel

New York

• • • **The nation will need** 1,350,000 tons of structural steel for the post-war highway bridge program just as soon as this steel can be released from war priorities, L. Abbett Post, Manager of the American Institute of Steel Construction reported recently.

The structural steel for bridges required in the various states ranges from 1750 tons needed in Nevada to 264,975 tons required in the state of New York. Ohio's demand is the second largest with a total of 100,375 tons.

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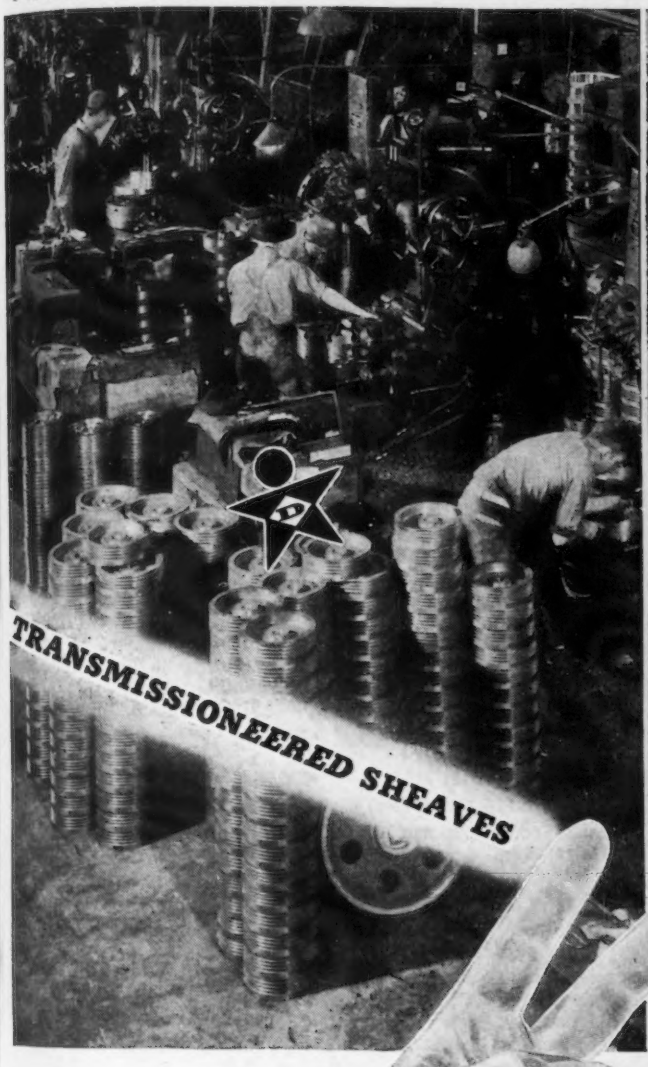

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THE RIGHT DRIVE FOR EVERY JOB

Comparison of Prices . . .

Advances Over Past Week in Heavy Type; Declines in *Italics*. [Prices Are F.O.B. Major Basing Points]

Flat Rolled Steel: (Cents Per Lb.)	July 11, 1944	July 4, 1944	June 6, 1944	July 13, 1943
Hot rolled sheets	2.10	2.10	2.10	2.10
Cold rolled sheets	3.05	3.05	3.05	3.05
Galvanized sheets (24 ga.)	3.50	3.50	3.50	3.50
Hot rolled strip	2.10	2.10	2.10	2.10
Cold rolled strip	2.80	2.80	2.80	2.80
Plates	2.10	2.10	2.10	2.10
Plates, wrought iron	3.80	3.80	3.80	3.80
Stain's c.r. strip (No. 302)	28.00	28.00	28.00	28.00
Tin and Terne Plate: (Dollars Per Base Box)				
Tin plate, standard cokes	$5.00	$5.00	$5.00	$5.00
Tin plate, electrolytic	4.50	4.50	4.50	4.50
Special coated mfg. ternes	4.30	4.30	4.30	4.30
Bars and Shapes: (Cents Per Lb.)				
Merchant bars	2.15	2.15	2.15	2.15
Cold finished bars	2.65	2.65	2.65	2.65
Alloy bars	2.70	2.70	2.70	2.70
Structural shapes	2.10	2.10	2.10	2.10
Stainless bars (No. 302)	24.00	24.00	24.00	24.00
Wrought iron bars	4.40	4.40	4.40	4.40
Wire and Wire Products: (Cents Per Lb.)				
Plain wire	2.60	2.60	2.60	2.60
Wire nails	2.55	2.55	2.55	2.55
Rails: (Dollars Per Gross Ton)				
Heavy rails	$40.00	$40.00	$40.00	$40.00
Light rails	40.00	40.00	40.00	40.00
Semi-Finished Steel: (Dollars Per Gross Ton)				
Rerolling billets	$34.00	$34.00	$34.00	$34.00
Sheet bars	34.00	34.00	34.00	34.00
Slabs, rerolling	34.00	34.00	34.00	34.00
Forging billets	40.00	40.00	40.00	40.00
Alloy blooms, billets, slabs	54.00	54.00	54.00	54.00
Wire Rods and Skelp: (Cents Per Lb.)				
Wire rods	2.00	2.00	2.00	2.00
Skelp	1.90	1.90	1.90	1.90

Pig Iron: (Per Gross Ton)	July 11, 1944	July 4, 1944	June 6, 1944	July 13, 1943
No. 2 fdy., Philadelphia	$25.84	$25.84	$25.84	$25.89
No. 2, Valley furnace	24.00	24.00	24.00	24.00
No. 2, Southern Cin'ti	25.11	25.11	25.11	24.68
No. 2, Birmingham	20.38	20.38	20.38	20.38
No. 2, foundry, Chicago†	24.00	24.00	24.00	24.00
Basic, del'd eastern Pa.	25.34	25.34	25.34	25.39
Basic, Valley furnace	23.50	23.50	23.50	23.50
Malleable, Chicago†	24.00	24.00	24.00	24.00
Malleable, Valley	24.00	24.00	24.00	24.00
L. S. charcoal, Chicago	37.34	37.34	37.34	31.34
Ferromanganese‡	135.00	135.00	135.00	135.00

†The switching charge for delivery to foundries in the Chicago district is 60c. per ton.
‡For carlots at seaboard.

Scrap: (Per Gross Ton)				
Heavy melt'g steel, P'gh.	$20.00	$20.00	$20.00	$20.00
Heavy melt'g steel, Phila.	18.75	18.75	18.75	18.75
Heavy melt'g steel, Ch'go	18.75	18.75	18.75	18.75
No. 1 hy. comp. sheet, Det.	17.85	17.85	17.85	17.85
Low phos. plate, Youngs'n	22.50	22.50	22.50	22.50
No. 1 cast, Pittsburgh	20.00	20.00	20.00	20.00
No. 1 cast, Philadelphia	20.00	20.00	20.00	20.00
No. 1 cast, Ch'go	20.00	20.00	20.00	20.00
Coke, Connellsville: (Per Net Ton at Oven)				
Furnace coke, prompt	$7.00	$7.00	$7.00	$6.50
Foundry coke, prompt	8.25	8.25	8.25	7.50
Non-Ferrous Metals: (Cents per Lb. to Large Buyers)				
Copper, electro., Conn.	12.00	12.00	12.00	12.00
Copper, Lake	12.00	12.00	12.00	12.00
Tin (Straits), New York	52.00	52.00	52.00	52.00
Zinc, East St. Louis	8.25	8.25	8.25	8.25
Lead, St. Louis	6.35	6.35	6.35	6.35
Aluminum, Virgin, del'd.	15.00	15.00	15.00	15.00
Nickel, electrolytic	35.00	35.00	35.00	35.00
Magnesium, ingot	20.50	20.50	20.50	20.50
Antimony (Asiatic), N. Y.	16.50	16.50	16.50	16.50

The various basing points for finished and semi-finished steel are listed in the detailed price tables, pages 155-163.

Composite Prices . . .

Starting with the issue of April 22, 1943, the weighted finished steel price index was revised for the years 1941, 1942 and 1943. See explanation of the change on page 90 of the April 22, 1943, issue.

	FINISHED STEEL	PIG IRON	SCRAP STEEL
July 11, 1944	2.25513c. a Lb.	$23.61 a Gross Ton	$19.17 a Gross Ton
One week ago	2.25513c. a Lb.	$23.61 a Gross Ton	$19.17 a Gross Ton
One month ago	2.25513c. a Lb.	$23.61 a Gross Ton	$19.17 a Gross Ton
One year ago	2.26190c. a Lb.	$23.61 a Gross Ton	$19.17 a Gross Ton

	FINISHED STEEL HIGH	FINISHED STEEL LOW	PIG IRON HIGH	PIG IRON LOW	SCRAP STEEL HIGH	SCRAP STEEL LOW
1943	2.25513c.,	2.25513c.,	$23.61	$23.61	$19.17	$19.17
1942	2.26190c.,	2.26190c.,	23.61	23.61	19.17	19.17
1941	2.43078c.,	2.43078c.,	$23.61, Mar. 20	$23.45, Jan. 2	$22.00, Jan. 7	$19.17, Apr. 10
1940	2.30467c., Jan. 2	2.24107c., Apr. 16	23.45, Dec. 23	22.61, Jan. 2	21.83, Dec. 30	16.04, Apr. 9
1939	2.35367c., Jan. 3	2.26689c., May 16	22.61, Sept. 19	20.61, Sept. 12	22.50, Oct. 3	14.08, May 16
1938	2.58414c., Jan. 4	2.27207c., Oct. 18	23.25, June 21	19.61, July 6	15.00, Nov. 22	11.00, June 7
1937	2.58414c., Mar. 9	2.32263c., Jan. 4	23.25, Mar. 9	20.25, Feb. 16	21.92, Mar. 30	12.67, June 8
1936	2.32263c., Dec. 28	2.05200c., Mar. 10	19.74, Nov. 24	18.73, Aug. 11	17.75, Dec. 21	12.67, June 9
1935	2.07642c., Oct. 1	2.06492c., Jan. 8	18.84, Nov. 5	17.83, May 14	13.42, Dec. 10	10.33, Apr. 29
1934	2.15367c., Apr. 24	1.95757c., Jan. 2	17.90, May 1	16.90, Jan. 27	13.00, Mar. 13	9.50, Sept. 25
1933	1.95578c., Oct. 3	1.75836c., May 2	16.90, Dec. 5	13.56, Jan. 3	12.25, Aug. 8	6.75, Jan. 3
1932	1.89196c., July 5	1.83901c., Mar. 1	14.81, Jan. 5	13.56, Dec. 6	8.50, Jan. 12	6.43, July 5
1931	1.99626c., Jan. 13	1.86586c., Dec. 29	15.90, Jan. 6	14.79, Dec. 15	11.33, Jan. 6	8.50, Dec. 29
1930	2.25488c., Jan. 7	1.97319c., Dec. 9	18.21, Jan. 7	15.90, Dec. 16	15.00, Feb. 18	11.25, Dec. 9
1929	2.31773c., May 28	2.26498c., Oct. 29	18.71, May 14	18.21, Dec. 17	17.58, Jan. 29	14.08, Dec. 3

Weighted index based on steel bars, beams, tank plates, wire, rails, black pipe, hot and cold-rolled sheets and strip, representing 78 per cent of the United States output. Index recapitulated in Aug. 28, 1941, issue.

Based on averages for basic iron at Valley furnaces and foundry iron at Chicago, Philadelphia, Buffalo, Valley and Southern iron at Cincinnati.

Based on No. 1 heavy melting steel scrap quotations to consumers at Pittsburgh, Philadelphia and Chicago.

. . . Prices of Finished Iron and Steel

Steel prices shown here are f.o.b. basing points, in cents per lb., unless otherwise indicated. Extras apply. Delivered prices do not reflect 3% tax on freight. (1) Mill run sheet, 10c. per lb. under base; primes 25c. above base. (2) Unassorted 8-lb. coating. (3) Widths up to 12-in. (4) 0.25 carbon and less. (5) Applise to certain width and length limitations. (6) For merchant trade. (7) For straight length material only from producer to consumer. Discount of 25c. per 100 lb. to fabricators. (8) Also shafting. For quantities of 20,000 to 29,999 lb. (9) Carload lot in manufacturing trade. (10) Prices do not apply if rail and water is not used. (12) Boxed. (13) Portland and Seattle price, San Francisco 2.50c. (14) This base price for annealed, bright finish wires, commercial spring wire.

Basing Point → / Product ↓	Pittsburgh	Chicago	Gary	Cleveland	Birmingham	Buffalo	Youngstown	Sparrows Point	Granite City	Middletown, Ohio	Gulf Ports, Cars	Provo, Utah	Pacific Ports, Cars[10]	DELIVERED TO Detroit	New York	Philadelphia
Hot Rolled Sheets	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢	2.20¢	2.10¢			2.65¢	2.20¢	2.34¢	2.27¢
Cold Rolled Sheets[1]	3.05¢	3.05¢	3.05¢	3.05¢		3.05¢	3.05¢		3.15¢	3.05¢			3.70¢	3.15¢	3.39¢	3.37¢
Galv. Sheets (24 gage)	3.50¢	3.50¢	3.50¢		3.50¢	3.50¢	3.50¢	3.50¢	3.60¢	3.50¢			4.05¢		3.74¢	3.67¢
Enameling Sheets (20 gage)	3.35¢	3.35¢	3.35¢	3.35¢			3.35¢		3.45¢	3.35¢			4.00¢	3.45¢	3.71¢	3.67¢
Long Ternes[2]	3.80¢	3.80¢	3.80¢										4.55¢		4.16¢	4.12¢
Hot Rolled Strip[3]	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢		2.10¢			2.10¢			2.75¢	2.20¢	2.46¢	
Cold Rolled Strip[4]	2.80¢	2.90¢		2.80¢			2.80¢	(Worcester = 3.00¢)						2.90¢	3.16¢	
Cooperage Stock Strip	2.20¢	2.30¢			2.20¢		2.20¢								2.56¢	
Commodity C-R Strip	2.95¢	3.05¢		2.95¢			2.95¢	(Worcester = 3.35¢)						3.05¢	3.31¢	
Coke Tin Plate, Base Box	$5.00	$5.00	$5.00						$5.10						5.36¢	5.32¢
.50 Electro Tin Plate, Box	$4.50	$4.50	$4.50						$4.60							
.75 Electro Tin Plate, Box	$4.65		$4.65						$4.75							
Black Plate (29 gage)[8]	3.05¢	3.05¢	3.05¢						3.15¢				4.05¢[13]			3 37¢
Mfg. Ternes, Special Box	$4.30	$4.30	$4.30						$4.40							
Carbon Steel Bars	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢		(Duluth = 2.25¢)			2.50¢		2.80¢	2.25¢	2. 49¢	2.47¢
Rail Steel Bars[6]	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢					2.50¢		2.80¢			
Reinforcing (Billet) Bars[7]	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢			2.50¢		2.55¢[12]	2.25¢	2.39¢	
Reinforcing (Rail) Bars[7]	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢				2.50¢		c2.55¢[12]	2.25¢		2.47¢
Cold Finished Bars[8]	2.65¢	2.65¢	2.65¢	2.65¢		2.65¢		(Detroit = 2.70¢)			(Toledo = 2.80¢)				2.99¢	2.97¢
Alloy Bars, Hot Rolled	2.70¢	2.70¢				2.70¢	(Bethlehem, Massillon, Canton = 2.70¢)							2.80¢		
Alloy Bars, Cold Drawn	3.35¢	3.35¢	3.35¢	3.35¢		3.35¢								3.45¢		
Carbon Steel Plates	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢		2.10¢	(Coatesville and Claymont = 2.10¢) 2.10¢	2.35¢		2.45¢	2.60¢	2.65¢	2.32¢	2.29¢	2.15¢
Floor Plates	3.35¢	3.35¢									3.70¢		4.00¢		3.71¢	3.67¢
Alloy Plates	3.50¢	3.50¢			(Coatesville = 3.50¢)						3.95		4 15¢		3.70¢	3.59¢
Structural Shapes	2.10¢	2.10¢	2.10¢		2.10¢	2.10¢	(Bethlehem = 2.10¢)				2.45¢		2.75¢		2.27¢	2.215¢
SPRING STEEL, C-R 0.26 to 0.50 Carbon	2.80¢			2.80¢			(Worcester = 3.00¢)									
0.51 to 0.75 Carbon	4.30¢			4.30¢			(Worcester = 4.50¢)									
0.76 to 1.00 Carbon	6.15¢			6.15¢			(Worcester = 6.35¢)									
1.01 to 1.25 Carbon	8.35¢			8.35¢			(Worcester = 8.55¢)									
Bright Wire[14]	2.60¢	2.60¢		2.60¢	2.60¢		(Worcester = 2.70¢)		(Duluth = 2.65¢)				3.10¢			2.92¢
Galvanized Wire	Add proper size extra and galvanizing extra to Bright Wire base.															
Spring (High Carbon)	3.20¢	3.20¢		3.20¢			(Worcester = 3.30¢)						3.70¢			3.53¢
Steel Sheet Piling	2.40¢	2.40¢				2.40¢							2.95¢			2.72¢

EXCEPTIONS TO PRICE SCHED. NO. 6

Slabs—Andrews Steel Co. $41 basing pts.; Wheeling Steel Corp. $34 Portsmouth, Ohio; Empire Sheet & Tin Plate Corp. $41; Phoenix Iron Co. (rerolling) $41, (forging) $47; Granite City Steel Co. $47.50.

Blooms—Phoenix Iron Co. (rerolling) $41, (forging) $47.

Sheet Bar—Empire Sheet & Tin Plate Co. $39 mill; Wheeling Steel Corp. $38 Portsmouth, Ohio.

Billets, Forging—Andrews Steel Co. $50 basing pts.; Follansbee Steel Corp. $49.50 Toronto; Phoenix Iron Co. $47.00 mill. Geneva Steel Co. $64.64 f.o.b. Pacific Coast Ports.

Billets, Rerolling—Continental Steel Corp. may charge Acme Steel in Chicago switching area $34 plus freight from Kokomo, Ind.; Northwestern Steel & Wire Co. (Lend-Lease) $41 mill; Wheeling Steel Corp. (small) $36 Portsmouth, Ohio; (blooming mill sizes) applicable base, f.o.b. Portsmouth, Ohio; Stanley Works may sell Washburn Wire Co. under allocation at $39 Bridgeport, Conn.; Keystone Steel & Wire Co. may sell Acme Steel Co. at Chicago base, f.o.b. Peoria; Phoenix Iron Co. $41 mill; Continental Steel Corp. (1¾ x 1¾) $39.50, (2 x 2) $40.60 Kokomo, Ind. (these prices include $1 size extra); Keystone Steel & Wire Co. $36.40 Peoria; Connors Steel Co. $50.69 Birmingham; Ford Motor Co. $34 Dearborn, Mich. Geneva Steel Co. $58.64 f.o.b. Pacific Coast ports.

Structural Shapes—Phoenix Iron Co. $2.35 basing pts. (export) $2.50 Phoenixville; Knoxville Iron Co. $2.30 basing points.

Bar Size Shapes—(Angles) W. Ames & Co., 10 tons or over, $3.10 mill.

Rails—Sweet Steel Co. (rail steel) $50 mill; West Virginia Rail Co. (lightweight) on allocation based Huntington, W. Va.; Colorado Fuel & Iron Corp., $45 Pueblo.

Hot Rolled Plate—Granite City Steel Co. $2.65 mill; Knoxville Iron Co. $2.25 basing pts.; Kaiser Co. and Geneva Steel Co. $3.20 Pacific Ports; Central Iron & Steel Co. $2.50 basing points; Granite City Steel Co. $2.35 Granite City.

Merchant Bars—W. Ames Co., 10 tons and over, $2.85 mill; Eckels-Nye Steel Corp., $2.50 basing pts. (rail steel) $2.40; Phoenix Iron Co. $2.40 basing pts.; Sweet Steel Co. (rail steel) $2.35 mill; Joslyn Mfg. & Supply Co., $2.35 Chicago; Calumet Steel Dic., Borg Warner Corp. (8 in. mill bars) $2.35 Chicago; Knoxville Iron Co. $2.30 basing pts. Laclede Steel Co., sales to LaSalle Steel granted Chicago base, f.o.b. Madison, Ill. Milton Mfg. Co. $2.75 f.o.b. Milton, Pa.

Logan Iron and Steel Co., Burnham, Pa., wrought iron bars, Grade I, $7.90 per 100 lb. f.o.b. plant. Ceiling is $7.40 per 100 lb.

Reinforcing Bars—W. Ames & Co., 10 tons and over, $2.85 mill; Sweet Steel Co. (rail steel) $2.35 mill; Columbia Steel Co. $2.50 Pacific Ports.

Cold Finished Bars—Keystone Drawn Steel Co. on allocation, Pittsburgh c.f. base plus c/l freight on hot rolled bars Pittsburgh to Spring City, Pa.; New England Drawn Steel Co. on allocation outside New England, Buffalo c.f. base plus c/l freight Buffalo to Massfield, Mass., f.o.b. Massfield; Empire Finished Steel Corp. on allocation outside New England, Buffalo c.f. base plus c/l freight Buffalo to plants f.o.b. plant; Compressed Steel Shafting Co. on allocation outside New England, Buffalo base plus c/l freight ville; Medart Co. in certain areas, Chi- Buffalo to Readville, Mass. f.o.b. Readcago c.f. base plus c/l freight Chicago to St. Louis, f.o.b. St. Louis.

Alloy Bars—Texas Steel Co. for delivery except Texas and Okla. Chicago base, f.o.b. Fort Worth, Tex.; Connors Steel Co. shipped outside Ala., Mississippi, Louisiana. Georgia, Florida, Tenn., Pittsburgh base, f.o.b. Birmingham.

Hot Rolled Strip—Joslyn Mfg. & Supply Co. $2.30 Chicago; Knoxville Iron Co. $2.25 basing pts.

Hot Rolled Sheets—Andrews Steel Co., Middletown base on shipments to Detroit or area; Parkersburg Iron & Steel Co., $2.25 Parkersburg.

Galvanized Sheets—Andrews Steel Co., $3.75 basing pts.; Parkersburg Iron & Steel Co. $3.85 Parkersburg; Apollo Steel Co. $3.75 basing pts.; Continental Steel Co., Middletown base on Kokomo, Ind., product; Superior Sheet Steel Co., Pittsburgh base except for Lend-Lease.

Pipe and Tubing—South Chester Tube Co. when priced at Pittsburgh, freight to Gulf Coast and Pacific Ports may be charged from Chester, Pa., also to points lying west of Harrisburg, Pa.

Black Sheets—Empire Sheet and Tinplate Co., maximum base price mill is $2.45 per 100 lb., with differentials, transportation charges, etc., provided in RPS. No. 6.

WAREHOUSE PRICES

Delivered metropolitan areas per 100 lb. These are zoned warehouse prices in conformance with latest zoning amendments to OPA Price Schedule 49.

Cities	SHEETS			STRIP		Plates ¼ in. and heavier	Structural Shapes	BARS		ALLOY BARS			
	Hot Rolled (10 gage)	Cold Rolled	Galvanized (24 gage)	Hot Rolled	Cold Rolled			Hot Rolled	Cold Finished	Hot Rolled, NE 8617-20	Hot Rolled, NE 9442-45 Ann.	Cold Drawn, NE 8617-20	Cold Drawn, NE 9442-4(Ann.
**Philadelphia	3.518	4.872[8]	5.018a	3.922	4.772	3.605	3.666	3.822	4.072	5.966	7.066	7.272	8.322
New York	3.590	4.613[3]	5.010	3.974[6]	4.772	3.768	3.758	3.853	4.103	6.008	7.108	7.303	8.353
Boston	3.744	4.744[9]	5.224[9]	4.106	4.715	3.912	3.912	4.044	4.144	6.162	7.262	7.344	8.394
Baltimore	3.394	4.852	4.894	3.902	4.752	3.594	3.759	3.802	4.052	....	....	....	....
Norfolk	3.771	4.965	5.371	4.165	4.865	3.971	4.002	4.065	4.165	....	....	....	....
Chicago	3.25	4.20	5.231	3.60	4.65[17]	3.55	3.55	3.50	3.75	5.75	6.85	6.85	7.90
Milwaukee	3.387	4.337[3]	5.272[4]	3.737	4.787[17]	3.687	3.687	3.637	3.887	5.987	7.087	7.087	8.137
Cleveland	3.35	4.40	4.877[4]	3.60	4.45	3.40	3.588	3.35	3.75	5.956	7.056	6.85	7.90
Buffalo	3.35	4.40	4.75[4]	3.819	4.689	3.63	3.40	3.35	3.75	5.75	6.85	6.85	7.90
Detroit	3.45	4.50	5.00[4]	3.70	4.659[17]	3.609	3.661	3.45	3.80	6.06	7.18	7.159	8.209
Cincinnati	3.425	4.475[3]	4.825[5]	3.675	4.711	3.611	3.691	3.611	4.011	....	....	....	....
St. Louis	3.397	4.347[3]	5.172[4]	3.747	4.931[17]	3.697	3.697	3.647	4.031	6.131	7.231	7.231	8.281
Pittsburgh	3.35	4.40	4.75	3.60	4.45	3.40	3.40	3.35	3.75	5.75	6.85	6.85	7.90
St. Paul	3.51	4.48	5.257[4]	3.88	4.351[7]	3.813[3]	3.813[3]	3.763[3]	4.361	6.09	7.19	7.561	8.711
Omaha	3.865	5.443	5.608[4]	4.215	....	4.165	4.165	4.115	4.43	....	....	....	....
Indianapolis	3.58	3.58	4.568	4.918	3.768	4.78	3.63	3.58	3.98	6.08	7.18	7.18	8.23
Birmingham	3.45	....	4.75	3.70	....	3.55	3.55	3.50	4.43	....	....	....	....
Memphis	3.965[7]	4.66	3.265	4.215	....	4.065	4.065	4.015	4.33	....	....	....	....
New Orleans	4.058*	4.95	5.358	4.308	....	4.158	4.158*	4.108*	4.629	....	....	....	....
Houston	3.763	5.573	6.313[1]	4.313	....	4.25	4.25	3.75	6.373[3]	7.223	8.323	8.323	9.373
Los Angeles	5.00	7.20[3]	6.10[4]	4.95	5.613[18]	4.95	4.65	4.40	5.583	8.304	9.404	9.404	10.454
San Francisco	4.55[14]	7.30[4]	6.35[4]	4.50[14]	7.333[17]	4.65[14]	4.35[14]	4.15[14]	5.333	8.304	9.404	9.404	10.454
Seattle	4.65[12]	7.05[4]	5.95[4]	4.25[12]	....	4.75[12]	4.45[12]	4.35[12]	5.783	....	9.404	....	....
Portland	4.65[11]	6.60[4]	5.75[4]	4.75[11]	....	4.75[11]	4.45[11]	4.45[11]	5.533	8.304	9.404	8.304	9.404
Salt Lake City	4.53[17]	....	6.17[18]	5.53[17]	....	4.98[17]	4.98[17]	4.88[17]	5.90	....	....	....	....

NATIONAL EMERGENCY (N. E.) STEELS
(Hot Rolled Mill Extras for Alloy Content)

Designation	CHEMICAL COMPOSITION LIMITS, PER CENT								Basic Open-Hearth		Electric Furnace	
	Carbon	Manganese	Phosphorus Max.	Sulphur Max.	Silicon	Chromium	Nickel	Molybdenum	Bars and Bar-Strip	Billets, Blooms and Slabs	Bars and Bar-Strip	Billets, Blooms and Slabs
NE 1330	.28/ .33	1.60/1.90	.040	.040	.20/ .35				.10c	$2.00		
NE 1335	.33/ .38	1.60/1.90	.040	.040	.20/ .35				.10	2.00		
NE 1340	.38/ .43	1.60/1.90	.040	.040	.20/ .35				.10	2.00		
NE 1345	.43/ .48	1.60/1.90	.040	.040	.20/ .35				.10	2.00		
NE 1350	.48/ .53	1.60/1.90	.040	.040	.20/ .35				.10	2.00		
NE 8613	.12/ .17	.70/ .90	.040	.040	.20/ .35	.40/ .60	.40/ .70	.15/ .25	.75	15.00	1.25c	$25.00
NE 8615	.13/ .18	.70/ .90	.040	.040	.20/ .35	.40/ .60	.40/ .70	.15/ .25	.75	15.00	1.25	25.00
NE 8617	.15/ .20	.70/ .90	.040	.040	.20/ .35	.40/ .60	.40/ .70	.15/ .25	.75	15.00	1.25	25.00
NE 8620	.18/ .23	.70/ .90	.040	.040	.20/ .35	.40/ .60	.40/ .70	.15/ .25	.75	15.00	1.25	25.00
NE 8630	.28/ .33	.70/ .90	.040	.040	.20/ .35	.40/ .60	.40/ .70	.15/ .25	.75	15.00	1.25	25.00
NE 8635	.33/ .38	.75/1.00	.040	.040	.20/ .35	.40/ .60	.40/ .70	.15/ .25	.75	15.00	1.25	25.00
NE 8637	.35/ .40	.75/1.00	.040	.040	.20/ .35	.40/ .60	.40/ .70	.15/ .25	.75	15.00	1.25	25.00
NE 8640	.38/ .43	.75/1.00	.040	.040	.20/ .35	.40/ .60	.40/ .70	.15/ .25	.75	15.00	1.25	25.00
NE 8642	.40/ .45	.75/1.00	.040	.040	.20/ .35	.40/ .60	.40/ .70	.15/ .25	.75	15.00	1.25	25.00
NE 8645	.43/ .48	.75/1.00	.040	.040	.20/ .35	.40/ .60	.40/ .70	.15/ .25	.75	15.00	1.25	25.00
NE 8650	.48/ .53	.75/1.00	.040	.040	.20/ .35	.40/ .60	.40/ .70	.15/ .25	.75	15.00	1.25	25.00
NE 8720	.18/ .23	.70/ .90	.040	.040	.20/ .35	.40/ .60	.40/ .70	.20/ .30	.80	16.00	1.30	26.00
NE 9255	.50/ .60	.70/ .95	.040	.040	1.80/2.20				.40	8.00		
NE 9260	.55/ .65	.70/1.00	.040	.040	1.80/2.20				.40	8.00		
NE 9261	.55/ .65	.70/1.00	.040	.040	1.80/2.20	.10/ .25			.65	13.00		
NE 9262	.55/ .65	.70/1.00	.040	.040	1.80/2.20	.25/ .40			.65	13.00		
NE 9415	.13/ .18	.80/1.10	.040	.040	.20/ .35	.30/ .50	.30/ .60	.08/ .15	.75	15.00	1.25	25.00
NE 9420	.18/ .23	.80/1.10	.040	.040	.20/ .35	.30/ .50	.30/ .60	.08/ .15	.75	15.00	1.25	25.00
NE 9422	.20/ .25	.80/1.10	.040	.040	.20/ .35	.30/ .50	.30/ .60	.08/ .15	.75	15.00	1.25	25.00
NE 9425	.23/ .28	.80/1.10	.040	.040	.20/ .35	.30/ .50	.30/ .60	.08/ .15	.75	15.00	1.25	25.00
NE 9430	.28/ .33	.90/1.20	.040	.040	.20/ .35	.30/ .50	.30/ .60	.08/ .15	.75	15.00	1.25	25.00
NE 9435	.33/ .38	.90/1.20	.040	.040	.20/ .35	.30/ .50	.30/ .60	.08/ .15	.75	15.00	1.25	25.00
NE 9437	.35/ .40	.90/1.20	.040	.040	.20/ .35	.30/ .50	.30/ .60	.08/ .15	.75	15.00	1.25	25.00
NE 9440	.38/ .43	.90/1.20	.040	.040	.20/ .35	.30/ .50	.30/ .60	.08/ .15	.75	15.00	1.25	25.00
NE 9442	.40/ .45	1.00/1.30	.040	.040	.20/ .35	.30/ .50	.30/ .60	.08/ .15	.80	16.00	1.30	26.00
NE 9445	.43/ .48	1.00/1.30	.040	.040	.20/ .35	.30/ .50	.30/ .60	.08/ .15	.80	16.00	1.30	26.00
NE 9450	.48/ .53	1.20/1.50	.040	.040	.20/ .35	.30/ .50	.30/ .60	.08/ .15	.80	16.00	1.30	26.00
NE 9537*	.35/ .40	1.20/1.50	.040	.040	.40/ .60	.40/ .60	.40/ .70	.15/ .25	1.20	24.00	1.70	34.00
NE 9540*	.38/ .43	1.20/1.50	.040	.040	.40/ .60	.40/ .60	.40/ .70	.15/ .25	1.20	24.00	1.70	34.00
NE 9542*	.40/ .45	1.20/1.50	.040	.040	.40/ .60	.40/ .60	.40/ .70	.15/ .25	1.20	24.00	1.70	34.00
NE 9545*	.43/ .48	1.20/1.50	.040	.040	.40/ .60	.40/ .60	.40/ .70	.15/ .25	1.20	24.00	1.70	34.00
NE 9550*	.48/ .53	1.20/1.50	.040	.040	.40/ .60	.40/ .60	.40/ .70	.15/ .25	1.20	24.00	1.70	34.00

*Recommended for large sections only. Note: The extras shown are in addition to a base price of 2.70c. per 100 lb., on finished products and $54 per gross ton on semi-finished steel major basing points and are in cents per 100 lb. and dollars per gross ton in semi-finished. When acid open-hearth is specified and acceptable add to basic open hearth alloy differential 0.25c. per lb. for bars and bar strip, $5.00 per gross ton for billets, blooms and slabs. The ranges shown above are restricted to sizes 100 sq. in. or less or equivalent cross sectional area 18 in. wide or under with a max. individual piece weight of 7000 lb.

Base Quantities

Standard unless otherwise keyed on prices.

HOT ROLLED: Sheets, strip, plates, shapes and bars, 400 to 1999 lb.

COLD ROLLED: Sheets, 400 to 1499 lb.; strip, extras on all quantities; bars, 1500 lb. base; NE alloy bars, 1000 to 39,999 lb.

EXCEPTIONS: (1) 150 to 499 lb. (2) 150 to 1499 lb. (3) 400 to 1499 lb. (4) 450 to 1499 lb. (5) 500 to 1499 lb. (6) 0 to 1999 lb. (7) 400 to 1999 lb. (8) 1000 to 1999 lb. (9) 450 to 3749 lb. (10) 400 to 3999 lb. (11) 300 to 4999 lb. (12) 300 to 10,000 lb. (13) 400 to 14,999 lb. (14) 400 lb. and over. (15) 1000 lb. and over. (16) 1500 lb. and over. (17) 2000 lb. and over. (18) 3500 lb. and over.

(a) **Philadelphia:** Galvanized sheets, 25 or more bundles.

Extra for size, quality, etc., apply on above quotations.

*Add 0.271c. for sizes not rolled in Birmingham.

**City of Philadelphia only. Applicable freight rates must be added to basing point prices to obtain delivered price to other localities in metropolitan area.

LAKE SUPERIOR ORES

(51.50% *Fe, Natural Content, Delivered Lower Lake Ports**)

	Per Gross Ton
Old range, bessemer, 51.50	$4.75
Old range, non-bessemer, 51.50	4.60
Mesaba, bessemer, 51.50	4.60
Mesaba, non-bessemer, 51.50	4.45
High phosphorus, 51.50	4.35

*Adjustments are made to indicate prices based on variance of Fe content of ores as analyzed on a dry basis by independent laboratories.

FLUORSPAR

Maximum price f.o.b. consumer's plant, $30 per short ton plus either (1) rail freight from producer to consumer, or (2) rail freight from Rosiclare, Ill., to consumer, whichever is lower.

Exception

When the WPB Steel Division certifies in writing the consumer's need for one of the higher grades of metallurgical fluorspar specified in the table below the price shall be taken from the table plus items (1 and 2) from paragraph above.

Effective CaF_2 Content:	*Base price per short ton*
70% or more	$33.00
65% but less than 70%	32.00
60% but less than 65%	31.00
Less than 60%	30.00

PRICES

SEMI-FINISHED STEEL

Ingots, Carbon, Rerolling

Base per gross ton, f.o.b. mill.... $31.00
Exceptions: Phoenix Iron Co. may charge $38.75; Kaiser Co., $43.00 f.o.b. Pacific Coast Ports; Empire Sheet & Tinplate Co., $34.25.

Ingots, Carbon, Forging

Base per gross ton, f.o.b. Birmingham, Buffalo, Chicago, Cleveland, Gary, Pittsburgh, Youngstown $36.00
Exceptions: Phoenix Iron Co. may charge $43.00; Empire Sheet & Tinplate Co., $39.25, f.o.b. Mansfield, Ohio; West Coast producers, $48.00, f.o.b. Pacific Coast Ports.

Ingots, Alloy

Base per gross ton, f.o.b. Bethlehem, Buffalo, Canton, Coatesville, Chicago, Massillon, Pittsburgh $45.00
Exceptions: C/L delivered Detroit add $2.00; delivered East Michigan add $3.00. Connors Steel Co. may charge $45.00 f.o.b. Birmingham.

Billets, Blooms and Slabs

Pittsburgh, Chicago, Gary, Cleveland, Youngstown, Buffalo, Birmingham, Sparrows Point (rerolling only). Prices delivered Detroit are $2.00 higher; delivered E. Michigan, $3 higher; f.o.b. Duluth, billets only, $2.00 higher; billets f.o.b. Pacific ports are $12 higher. Provo, $11.20 higher. Delivered prices do not reflect three per cent tax on freight rates.

	Per Gross Ton
Rerolling	$34.00
Forging quality	40.00

For exceptions on semi-finished steel see the footnote on the page of finished steel prices.

Alloy Billets, Blooms, Slabs

Pittsburgh, Chicago, Canton, Massillon, Buffalo, or Bethlehem, per gross ton 54.00
Price delivered Detroit $2.00 higher: E. Michigan $3.00 higher.

Shell Steel

	Per Gross Ton
3 in. to 12 in.	$52.00
12 in. to 18 in.	54.00
18 in. and over	56.00

Basic open hearth shell steel, f.o.b. Pittsburgh, Chicago, Buffalo, Gary, Cleveland, Youngstown and Birmingham.
Prices delivered Detroit are $2.00 higher; E. Michigan, $3 higher.
Note: The above base prices apply on lots of 1000 tons of a size and section to which are to be added extras for chemical requirements, cutting, or quantity.

Sheet Bars

Pittsburgh, Chicago, Cleveland, Youngstown, Buffalo, Canton, Sparrows Point.

	Per Gross Ton
Open hearth or bessemer	$34.00

Skelp

Pittsburgh, Chicago, Youngstown, Coatesville, Pa., Sparrows Point, Md.

	Per Lb.
Grooved, universal and sheared	1.90c.

Wire Rods

(No. 5 to 9/32 in.)

	Per Lb.
Pittsburgh, Chicago, Cleveland	2.00c.
Worcester, Mass.	2.10c.
Birmingham	2.00c.
San Francisco	2.50c.
Galveston	2.25c.

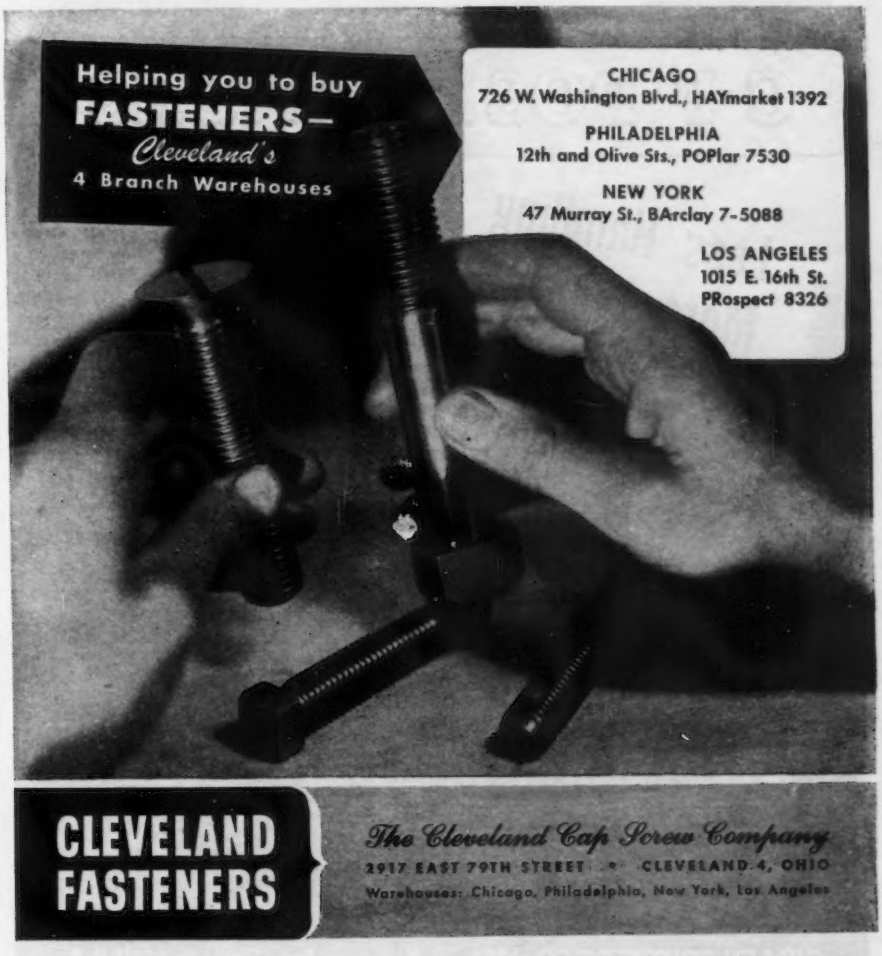
9/32 in. to 47/64 in., 0.15c. a lb. higher. Quantity extras apply.

TOOL STEEL

(F.o.b. Pittsburgh, Bethlehem, Syracuse)

	Base per lb.
High speed	67c.
Straight molybdenum	54c.
Tungsten-molybdenum	57½c.
High-carbon-chromium	43c.
Oil hardening	24c.
Special carbon	22c.
Extra carbon	18c.
Regular carbon	14c.

Warehouse prices east of Mississippi are 2c. a lb. higher; west of Mississippi 3c. higher.



CLARKAT
TRUCTRACTOR
Moves Material
FASTER
TO POINT OF USE
Another PRODUCT of CLARK EQUIPMENT COMPANY
Pulls twenty times its own weight on trailers... SMALL... COMPACT... EFFICIENT... gas powered for 24 hour service.
WRITE FOR NEW VEST POCKET CATALOG!
CLARK TRUCTRACTOR
DIVISION OF CLARK EQUIPMENT COMPANY
BATTLE CREEK, MICHIGAN, U.S.A.

C-F POSITIONERS

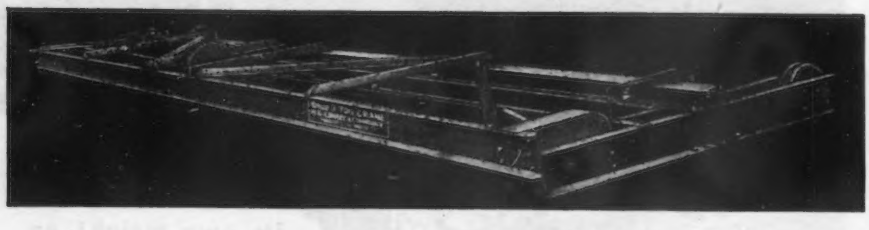
Less Handling More Welding

C-F Positioners enable you to do down-hand welding on any part of the weldment, top, bottom, sides—to produce more uniformly perfect welds—stronger joints, smoother, neater fillets and beads which require less grinding. Eliminates handling delays, converts *"handling time"* into *"welding time"*—saves crane service, saves floor space. Table revolves a full 360°, tilts up to 135° beyond horizontal, and is adjustable for height. Models taking up to 30,000 lbs., handle wide range of work, handle larger unbalanced loads. Hand or push button operation. These are universal tools—pedestal or boom mounted to give maximum floor and working clearance.

Write for Bulletin WP-22

CULLEN-FRIESTEDT CO., 1303 S. Kilbourn Ave., Chicago 23, U.S.A.

CONCO 3-Motor Single Girder CAB OR FLOOR OPERATED ELECTRIC CRANE . . .



● **Available in capacities of one through five tons for floor or cab operation. Simply, ruggedly designed for low first cost and maintenance. Used with Low Headroom Type Hoist, provides for maximum space coverage horizontally and vertically. Effective in even a minimum space. Write for Bulletin 2000.**

Write for Bulletin 26000 describing the Torpedo Hoist shown. Three capacities 250 lb. — $139.50, 500 lb. — $149.50, 1000 lb. — $159.50. Heavily, simply built, with Push Button Control. Outstanding in CONCO'S complete line of hand-powered and electric Cranes, Hoists, Trolleys.

CONCO ENGINEERING WORKS

Div. of H. D. Conkey & Co. — 15 Grove St. — Mendota, Ill.

Builders Of Conco Torpedo Electric Hoist

PRICES

WELDED PIPE AND TUBING

Base Discounts, f.o.b. Pittsburgh District and Lorain, Ohio, Mills

(F.o.b. Pittsburgh only on wrought pipe)
Base Price—$200.00 per Net Ton

	Black	Galv.
Steel (Butt Weld)		
½ in.	63½	51
¾ in.	66½	55
1 to 3 in.	68½	57½
Wrought Iron (Butt Weld)		
½ in.	24	3½
¾ in.	30	10
1 and 1¼ in.	34	16
1½ in.	38	18½
2 in.	37½	18
Steel (Lap Weld)		
2 in.	61	49½
2½ and 3 in.	64	52½
3½ to 6 in.	66	54½
Wrought Iron (Lap Weld)		
2 in.	30½	12
2½ to 3½ in.	31½	14½
4 in.	33½	18
4½ to 8 in.	32½	17
Steel (Butt, extra strong, plain ends)		
½ in.	61½	50½
¾ in.	65½	54½
1 to 3 in.	67	57
Wrought Iron (Same as Above)		
½ in.	25	6
¾ in.	31	12
1 to 2 in.	38	19½
Steel (Lap, extra strong, plain ends)		
2 in.	59	43½
2½ and 3 in.	63	52½
3½ to 6 in.	66½	56
Wrought Iron (Same as Above)		
2 in.	33⅓	15½
2½ to 4 in.	39	22½
4½ to 6 in.	37½	21

On butt weld and lap weld steel pipe jobbers are granted a discount of 5%. On less-than-carload shipments prices are determined by adding 25 and 30% and the carload freight rate to the base card.

F.o.b. Gary prices are two points lower discount or $4 a ton higher than Pittsburgh or Lorain on lap weld and one point lower discount, or $2 a ton higher on all butt weld.

CAST IRON WATER PIPE

	Per Net Ton
6-in. and larger, del'd Chicago	$54.80
6-in. and larger, del'd New York	52.20
6-in. and larger, Birmingham	46.00
6-in. and larger f.o.b. cars, San Francisco or Los Angeles	69.40
6-in. and larger f.o.b. cars, Seattle	71.20

Class "A" and gas pipe, $3 extra; 4-in. pipe is $3 a ton above 6-in. Prices shown are for lots of less than 200 tons. For 200 tons or over, 6-in. and larger are $45 at Birmingham and $53.80 delivered Chicago, $59.40 at San Francisco and Los Angeles, and $70.20 at Seattle. Delivered prices do not reflect new 3 per cent tax on freight rates.

BOILER TUBES

Seamless Steel and Lap Weld Commercial Boiler Tubes and Locomotive Tubes, Minimum Wall. Net base prices per 100 ft. f.o.b. Pittsburgh, in carload lots.

	Seamless Cold Drawn	*Seamless Hot Rolled*	*Lap Weld, Hot Rolled*
2 in. o.d. 13 B.W.G.	15.03	13.04	12.35
2½ in. o.d. 12 B.W.G.	20.21	17.54	16.53
3 in. o.d. 12 B.W.G.	22.48	19.50	18.35
3½ in. o.d. 11 B.W.G.	28.37	24.62	23.15
4 in. o.d. 10 B.W.G.	35.20	30.54	28.66

(Extras for less carload quantities)

40,000 lb. or ft., and over	Base
30,000 lb. or ft. to 39,999 lb. or ft.	5%
20,000 lb. or ft. to 29,999 lb. or ft.	10%
10,000 lb. or ft. to 19,999 lb. or ft.	20%
5,000 lb. or ft. to 9,999 lb. or ft.	30%
2,000 lb. or ft. to 4,999 lb. or ft.	45%
Under 2,000 lb. or ft.	65%

PRICES

WIRE PRODUCTS

To the trade, f.o.b. Pittsburgh, Chicago, Cleveland, Birmingham, Duluth

	Basing Points Named	Pacific Coast Basing Points†
	Base per Keg	
Standard wire nails	$2.55	$3.05
Coated nails	2.55	3.05
Cut nails, carloads	3.85	....
	Base per 100 Lb.	
Annealed fence wire	$3.05	$3.55
Annealed galv. fence wire	3.40	3.90
	Base Column	
Woven wire fence*	$0.67	$0.85
Fence posts, carloads	.69	.86
Single loop bale ties	.59	.84
Galvanized barbed wire**	.70	.80
Twisted barbless wire	.70	....

*15½ gage and heavier. **On 80-rod spools in carload quantities.
†Prices subject to switching or transportation charges.

BOLTS, NUTS, RIVETS, SET SCREWS

Bolts and Nuts

(F.o.b. Pittsburgh, Cleveland, Birmingham or Chicago)

Machine and Carriage Bolts:

Base discount less case lots

	Per Cent Off List
½ in. & smaller x 6 in. & shorter	65½
9/16 & ⅝ in. x 6 in. & shorter	63½
¾ to 1 in. x 6 in. & shorter	61
1¼ in. and larger, all lengths	59
All diameters over 6 in. long	59
Lag, all sizes	62
Plow bolts	65

Nuts, Cold Punched or Hot Pressed:
(Hexagon or Square)

½ in. and smaller	62
9/16 to 1 in. inclusive	59
1⅛ to 1⅛ in. inclusive	57
1⅛ in. and larger	56

On above bolts and nuts, excepting plow bolts, additional allowance of 10 per cent for full container quantities. There is an additional 5 per cent allowance for carload shipments.

Semi-Fin. Hexagon Nuts	U.S.S.	S.A.E.
Base discount less keg lots		
7/16 in. and smaller	..	64
½ in. and smaller	62	..
½ in. through 1 in.	..	60
9/16 in. to 1 in.	59	..
1⅛ in. through 1½ in.	57	58
1⅝ in. and larger	56	..

In full keg lots, 10 per cent additional discount.

Stove Bolts — *Consumer*

Packages, nuts loose	71 and 10
In packages, with nuts attached	71
In bulk	80

On stove bolts freight allowed up to 65c per 100 lb. based on Cleveland, Chicago, New York on lots of 200 lb. or over.

Large Rivets
(½ in. and larger)

	Base per 100 lb.
F.o.b. Pittsburgh, Cleveland, Chicago, Birmingham	$3.75

Small Rivets
(7/16 in. and smaller)

	Per Cent Off List
F.o.b. Pittsburgh, Cleveland, Chicago, Birmingham	65 and 5

Cap and Set Screws — *Consumer Per Cent Off List*

Upset full fin. hexagon head cap screws, coarse or fine thread, up to and incl. 1 in. x 6 in.	64
Upset set screws, cup and oval points	71
Milled studs	46
Flat head cap screws, listed sizes	36
Fillister head cap, listed sizes	51

Freight allowed up to 65c per 100 lb. based on Cleveland, Chicago or New York on lots of 200 lb. or over.

ROOFING TERNE PLATE

(F.o.b. Pittsburgh, 112 Sheets)

	20x14 in.	20x28 in.
8-lb. coating I.C.	$6.00	$12.00
15-lb. coating I.C.	7.00	14.00
20-lb. coating I.C.	7.50	15.00

PERFORATED METALS
INDUSTRIAL and ORNAMENTAL
To produce the highest quality of perforated metal as used in the industrial arts and for ornamentation has been the ambition and persistent endeavor of this company. The highest quality best serves the user. We are here to serve you.

ANY METAL • ANY PERFORATION

The Harrington & King PERFORATING CO.

5657 FILLMORE STREET—CHICAGO 44, ILL.
Eastern Office: 114 Liberty Street, New York 6, N. Y.

★ ★

PRECISION WORK ON SMALL PARTS

(up to 20 lbs.)

Induction heat-treating (30 KW)
External Grinding (up to 10" x 36")
Internal Grinding
Surface Grinding (plain and rotary)
Milling—vertical, horizontal, contour
Duplicating
Automatic lathe work
Etc.

For list of equipment, pictures and other information concerning plant write

GENERAL REFINERIES, INC.

27 NORTH 4TH STREET, MINNEAPOLIS 1, MINNESOTA

★ ★

PIG IRON

All prices set in bold face type are maxima established by OPA on June 24, 1941. Other domestic prices (in italics) are delivered quotations per gross ton computed on the basis of the official maxima. Delivered prices do not reflect 3 per cent tax on freight rates.

	No. 2 Foundry	Basic	Bessemer	Malleable	Low Phosphorus	Charcoal
Boston	*$25.50*	*$25.00*	*$26.50*	*$26.00*	.....	.....
Brooklyn	*27.50*	*27.00*		*28.00*	.....	.....
Jersey City	*26.53*	*26.03*	*27.53*	*27.03*	.....	.....
Philadelphia (4)	*25.84*	*25.34*	*26.84*	*26.34*	*$30.74*	.....
Bethlehem, Pa.	25.00	24.50	26.00	25.50	.....	.....
Everett, Mass.	25.00	24.50	26.00	25.50	.....	.....
Swedeland, Pa.	25.00	24.50	26.00	25.50	.....	.....
Steelton, Pa.		24.50			29.50	.....
Birdsboro, Pa. (3)	25.00	24.50	26.00	25.50	29.50	.....
Sparrows Point, Md.	25.00	24.50			.....	.....
Erie, Pa.	24.00	23.50	25.00	24.50	.....	.....
Neville Island, Pa.	24.00	23.50	24.50	24.00	.....	.....
Sharpsville, Pa. (1)	24.00	23.50	24.50	24.00	.....	.....
Buffalo	24.00	23.00	25.00	24.50	29.50	.....
Cincinnati, Ohio	*25.11*	*24.61*	.....	*25.11*	.....	.....
Canton, Ohio	*25.39*	*24.89*	*25.89*	*25.39*	*32.69*	.....
Mansfield, Ohio	*25.94*	*25.44*	*26.44*	*25.94*	*32.86*	.....
St. Louis	*24.50*	*24.50*	.....	.....	.....	.....
Chicago	24.00	23.50	24.50	24.00	*35.46*	.....*$37.34*
Granite City, Ill	24.00	23.50	24.50	24.00	.....	.....
Cleveland	24.00	23.50	24.50	24.00	*32.42*	.....
Hamilton, Ohio	24.00	23.50		24.00	.....	.....
Toledo	24.00	23.50	24.50	24.00	.....	.....
Youngstown	24.00	23.50	24.50	24.00	*32.42*	.....
Detroit	24.00	23.50	24.50	24.00	.....	.....
Lake Superior fc.	...	.....	.....	.....	.....	34.00
Lyles, Tenn. fc. (2)	...	.....	.....	.....	.....	33.00
St. Paul	*26.63*	26.13	*27.13*	*26.63*	*39.80*	.....
Duluth	24.50	24.00	25.00	24.50	...	.....
Birmingham	20.38	19.00	25.00	.....	.....	.....
Los Angeles	*26.95*	...	.....	.....	.....	.....
San Francisco	*26.95*	...	.....	.....	.....	.....
Seattle	*26.95*	...	.....	.....	.....	.....
Provo, Utah	22.00	21.50	.....	.....	.....	.....
Montreal	*27.50*	*27.50*	.....	*28.00*	.....	.....
Toronto	*25.50*	*25.50*	.....	*26.00*	.....	.....

GRAY FORGE IRON: Valley or Pittsburgh furnace $23.50

(1) Pittsburgh Coke & Iron Co. (Sharpsville, Pa., furnace only) and the Struthers Iron and Steel Co., Struthers, Ohio, may charge 50c. a ton in excess of basing point prices for No. 2 foundry, basic, bessemer and malleable. Struthers Iron and Steel Co. may add another $1.00 per gross ton for iron from Struthers, Ohio, plant.

(2) Price shown is for low-phosphorous iron; high phosphorous sells for $28.50 at the furnace.

(3) E. & G. Brooke Co. Birdsboro, Pa., permitted to charge $1.00 per ton extra.

(4) Pittsburgh Ferromanganese Co. (Chester furnace only) may charge $2.25 a ton over maximum basing point prices.

Basing point prices are subject to switching charges; Silicon differentials (not to exceed 50c. a ton for each 0.25 per cent silicon content in excess of base grade which is 1.75 to 2.25 per cent); Phosphorus differentials, a reduction of 38c. per ton for phosphorus content of 0.70 per cent and over; Manganese differentials, a charge not to exceed 50c. per ton for each 0.50 per cent manganese content in excess of 1.00 per cent. Effective March 3, 1943, $2 per ton extra may be charged for 0.5 to 0.75 per cent nickel content and $1 per ton extra for each additional 0.25 per cent nickel.

METAL POWDERS

Prices are based on current market prices of ingots plus a fixed figure. F.o.b. shipping point, c. per lb., ton lots.

Copper, electrolytic, 150 and 200 mesh	21⅛ to 23⅛c.
Copper, reduced, 150 and 200 mesh	20½ to 25½c.
Iron, commercial, 100 and 200 mesh, 96 + % Fe	13½ to 15c.
Iron, crushed, 200 mesh and finer, 90 + % Fe	4c.
Iron, hydrogen reduced, 300 mesh and finer, 98½ + % Fe	63c.
Iron, electrolytic, unannealed, 300 mesh and coarser, 99 + % Fe	30 to 33c.
Iron, electrolytic, annealed minus 100 mesh, 99 + % Fe	42c.
Iron, carbonyl, 300 mesh and finer, 98-99.8 + % Fe	90c.
Aluminum, 100 and 200 mesh	*23 to 27c.
Antimony, 100 mesh	30.6c.
Cadmium, 100 mesh	$1
Chromium, 150 mesh	$1.08
Lead, 100, 200 & 300 mesh,	11½ to 12½c.
Manganese, 150 mesh	51c.
Nickel, 150 mesh	51½c.
Solder powder, 100 mesh, 8½c. plus metal	
Tin, 100 mesh	53¾c.
Tungsten metal powder, 98%-99%, any quantity, per lb.	$2.60
Molybdenum power, 99%, in 200-lb. kegs, f.o.b. York, Pa., per lb.	$2.60
Under 100 lb.	$3.00

*Freight allowed east of Mississippi.

COKE

	Net Ton
Furnace, beehive (f.o.b. oven)	
Connellsville, Pa.	$7.00*
Foundry, beehive (f.o.b. oven)	
Fayette Co., W. Va.	8.10
Connellsville, Pa.	8.25
Foundry, By-Product	
Chicago, del'd	13.35
Chicago, f.o.b.	12.60
New England, del'd	14.25
Kearny, N. J., f.o.b.	12.65
Philadelphia, del'd	12.88
Buffalo, del'd	13.00
Portsmouth, Ohio, f.o.b.	11.10
Painesville, Ohio, f.o.b.	11.75
Erie, del'd	12.75
Cleveland, del'd	12.80
Cincinnati, del'd	12.85
St. Louis, del'd	13.85
Birmingham, del'd	10.50

*Hand drawn ovens using trucked coal permitted to charge $7.75 per ton plus transportation charges. **Mo., Ala., and Tenn. producers—$13.35.

HEAT-TREATED STEEL SHOT

We manufacture shot and grit for endurance

Heat-Treated Steel Shot and Heat-Treated Steel Grit

A shot or grit that will blast fast with a clean finish.

This is the only reason why so many operators are daily changing to our shot and grit, from Maine to California.

The unprecedented demand for our—

has enabled us to expand our production and maintain a quality that is more than satisfactory to our hundreds of customers all over the country.

HARRISON ABRASIVE CORPORATION

Manchester, New Hampshire

HEAT-TREATED STEEL GRIT

PRICES

REFRACTORIES
(F.o.b. Works)

	Per 1000
Fire Clay Brick	
Super-duty brick, St. Louis	$64.60
First quality, Pa., Md., Ky., Mo., Ill.	51.30
First quality, New Jersey	56.00
Sec. quality, Pa., Md., Ky., Mo., Ill.	46.55
Second quality, New Jersey	51.00
No. 1, Ohio	43.00
Ground fire clay, net ton	7.60
Silica Brick	
Pennsylvania and Birmingham	$51.30
Chicago District	58.90
Silica cement, net ton (Eastern)	9.00
	Per Net Ton
Chrome Brick	
Standard chemically bonded, Balt., Plymouth Meeting, Chester	$54.00
Magnesite Brick	
Standard, Balt. and Chester	$76.00
Chemically bonded, Baltimore	65.00
Grain Magnesite	
Domestic, f.o.b. Balt. and Chester in sacks (carloads)	$43.48
Domestic, f.o.b. Chewelah, Wash. (in bulk)	22.00

RAILS, TRACK SUPPLIES
(F.o.b. Mill)

Standard rails, heavier than 60 lb., No. 1 O.H., gross ton	$40.00
Angle splice bars, 100 lb.	2.70
(F.o.b. Basing Points)	**Per Gross Ton**
Light rails (from billets)	$40.00
Light rails (from rail steel)	39.00
	Base per Lb.
Cut spikes	3.00c.
Screw spikes	5.15c.
Tie plates, steel	2.15c.
Tie plates, Pacific Coast	2.30c.
Track bolts	4.75c.
Track bolts, heat treated, to railroads	5.00c.
Track bolts, jobbers discount	63-5

Basing points, light rails, Pittsburgh, Chicago, Birmingham; cut spikes and tie plates—Pittsburgh, Chicago, Portsmouth, Ohio, Weirton, W. Va., St. Louis, Kansas City, Minnequa, Colo., Birmingham and Pacific Coast ports; tie plates alone—Steelton, Pa., Buffalo. Cut spikes alone—Youngstown, Lebanon, Pa., Richmond, Oregon and Washington ports, add 25c.

CORROSION AND HEAT-RESISTING STEEL
(Per lb. base price, f.o.b. Pittsburgh)

Chromium-Nickel Alloys

	No. 304	No. 302
Forging billets	21.25c.	20.40c.
Bars	25.00c.	24.00c.
Plates	29.00c.	27.00c.
Structural shapes	25.00c.	24.00c.
Sheets	36.00c.	34.00c.
Hot rolled strip	23.50c.	21.50c.
Cold rolled strip	30.00c.	28.00c.
Drawn wire	25.00c.	24.00c.

Straight-Chromium Alloys

	No. 410	No. 430	No. 442	No. 446
F.Billets	15.725c.	16.15c.	19.125c.	23.375c.
Bars	18.50c.	19.00c.	22.50c.	27.50c.
Plates	21.50c.	22.00c.	25.50c.	30.50c.
Sheets	26.50c.	29.00c.	32.50c.	36.50c.
Hot strip	17.00c.	17.50c.	24.00c.	35.00c.
Cold strip	22.00c.	22.50c.	32.00c.	52.00c.

Chromium-Nickel Clad Steel (20%)

	No. 304
Plates	18.00c.*
Sheets	19.00c.

*Includes annealing and pickling.

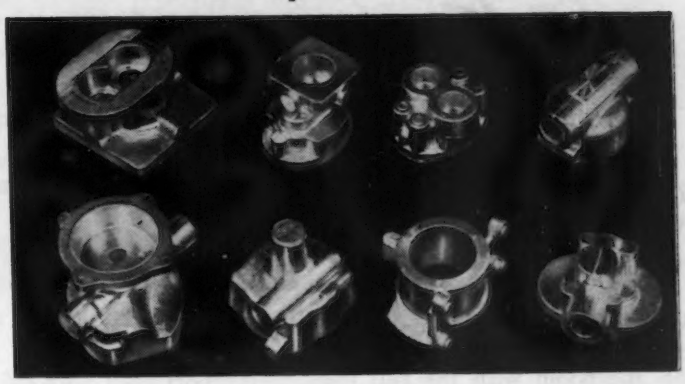
ELECTRICAL SHEETS
(Base, f.o.b. Pittsburgh)

	Per Lb.
Field grade	3.20c.
Armature	3.55c.
Electrical	4.05c.
Motor	4.95c.
Dynamo	5.65c.
Transformer 72	6.15c.
Transformer 65	7.15c.
Transformer 58	7.65c.
Transformer 52	8.45c.

F.o.b. Granite City, add 10c. per 100 lb. on field grade to and including dynamo. Pacific ports add 75c. per 100 lb. on all grades.

PERMANENT MOLD
ALUMINUM CASTINGS
A Complete Service!

Design • Quantity • Quality • Delivery



Permanent Molds manufactured
Heat Treated to all specifications
Deliveries to meet all schedules
Aluminum Castings produced in any quantities
X-Ray and other inspection controls
Send in your inquiries for war and civilian requirements

NATIONAL
ALUMINUM MFG. CO., PEORIA, ILL.

CHICAGO: 1424A, Merchandise Mart DETROIT: 8-254 General Motors Building BUFFALO: 837 Potomac St.

"HERCULES" RED-STRAND WIRE ROPE

You Can Depend On "Hercules" (Red Strand) Wire Rope

Highlights of Quality

1. Acid Open-Hearth Steel Wire
2. Rigid Tests and Inspections
3. Correct Manufacturing Methods
4. Furnished in both the Round and Flattened Strand constructions, in either Standard or Preformed Type.

• • Results are what count, and the performance record of this wire rope continues to make and hold friends.

There is no guess work when you use "HERCULES" (Red-Strand) Wire Rope. It is designed and built to do specific jobs better . . . safer . . . more economically. If you will tell us how you use wire rope, we shall be glad to suggest the construction and type most suitable for your conditions.

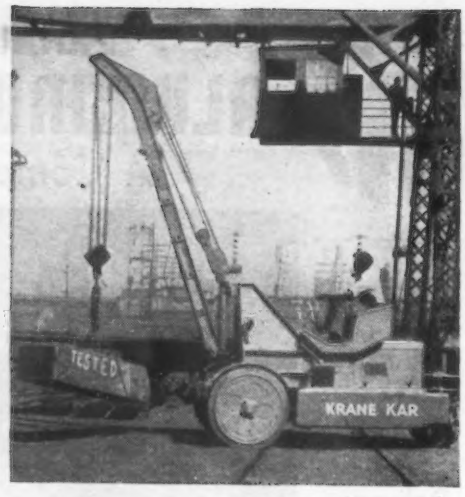
MADE ONLY BY
A. LESCHEN & SONS ROPE CO.
WIRE ROPE MAKERS — ESTABLISHED 1857
5909 KENNERLY AVENUE — ST. LOUIS, MISSOURI, U.S.A.

NEW YORK • • • 90 West Street
CHICAGO • • 810 W. Washington Blvd.
DENVER • • • 1554 Wazee Street
SAN FRANCISCO • • 520 Fourth Street
PORTLAND • • 914 N. W. 14th Avenue
SEATTLE • • 3410 First Avenue South

HOW TO HANDLE STEEL *Faster*

KRANE KAR

The ORIGINAL Swing Boom Mobile Crane with front-wheel drive and rear-wheel steer



Move a KRANE KAR up to a pile of forgings, bars, blooms, billets, ingots, castings (or a scrap heap when equipped with an electric magnet), and top the boom with the full load. Transport load forward or backward and position it on either side in places inaccessible to a rigid boom crane. Make speed with the all-around safety features—stability without outriggers or jacks, automatic braking of load and boom, easy steering and utter simplicity of operation. Short turning radius and ability to clear low overhead make KRANE KAR just as useful indoors as outdoors, especially for plant and furnace repairs. 11 to 35 ft. booms, solid or pneumatic tires.

Write for Catalog

2½, 5, AND 10 TON CAPACITIES

Krane kar

SILENT HOIST WINCH & CRANE CO., 851 63RD ST., BROOKLY

BRONZE BEARINGS
OILLESS BRONZE BEARINGS
GEAR BLANKS
MACHINED BRONZE PARTS

S & H Bronze Bearings can be furnished in any size or quantity to meet your particular requirements.

Our equipment and manufacturing methods enable us to meet the most exacting specifications and design.

INDUSTRIAL BETTER B BEARINGS **BEARINGS**

S. & H. Bearing and Manufacturing Co., Inc.
340-344 North Avenue, East
Cranford New Jersey

PRICES

Ferromanganese

78-82% Mn, maximum contract base price per gross ton, lump size, f.o.b. car at Baltimore, Bethlehem, Philadelphia, New York, Birmingham, Rockdale, Rockwood, Tenn.

Carload lots (bulk)	$135.00
Carload lots (packed)	141.00
Less ton lots (packed)	148.50

Premium, $1.70 for each 1% above 82% Mn; penalty, $1.70 for each 1% below 78%.

Manganese Metal

Contract basis, lump size, per lb. of metal, f.o.b. shipping point with freight allowed. Spot sales add 2c. per lb.

96-98% Mn, .2% max. C, 1% max. Si, 2% max. Fe.

Carload, bulk	34c.
L.c.l. lots	35c.

95-97% Mn, .2% max. C, 1.5% max. Si, 2.5% max. Fe.

Carload, bulk	34c.
L.c.l. lots	35c.

Spiegeleisen

Maximum base, contract prices, per gross ton, lump, f.o.b. Palmerton, Pa.

	16-19% Mn 3% max. Si	19-21% Mn 3% max. Si
Carloads	$35.00	$36.00
Less ton	47.50	48.50

Electric Ferrosilicon

OPA maximum base price cents per lb. contained Si, lump size in carlots, f.o.b. shipping point with freight allowed to destination.

	Eastern Zone	Central Zone	Western Zone
50% Si	6.65c.	7.10c.	7.25c.
75% Si	8.05c.	8.20c.	8.75c.
80-90% Si	8.90c.	9.05c.	9.55c.
90-95% Si	11.05c.	11.20c.	11.65c.

Spot sales add: .45c. per lb. for 50% Si, .3c. per lb. or 75% Si .25c. per lb. for 80-90% and 90-95% Si.

Silvery Iron

(Per Gross Ton, base 6.00 to 6.50 Si)

F.o.b. Jackson, Ohio	$29.50*
Buffalo	30.75*

For each additional 0.50% silicon add $1 a ton. For each 0.50% manganese over 1% add 50c. a ton. Add $1 a ton for 0.75% phosphoros or over.

*OPA price established 6-24-41.

Bessemer Ferrosilicon

Prices are $1 a ton above silvery iron quotations of comparable analysis.

Silicon Metal

OPA maximum base price per lb. of contained Si, lump size, f.o.b. shipping point with freight allowed to destination, for l.c.l. above 2000 lb., packed. Add .25c. for spot sales.

	Eastern Zone	Central Zone	Western Zone
96% Si, 2% Fe.	13.10c.	13.55c.	16.50c.
97% Si, 1% Fe.	13.45c.	13.90c.	16.80c.

Ferrosilicon Briquets

OPA maximum base price per lb. of briquet, bulk, f.o.b. shipping point with freight allowed to destination. Approximately 40% Si. Add .25c. for spot sales.

	Eastern Zone	Central Zone	Western Zone
Carload, bulk	3.35c.	3.50c.	3.65c.
2000 lb.-carload	3.8c.	4.2c.	4.25c.

Silicomanganese

Contract basis lump size, per lb. of metal, f.o.b. shipping point with freight allowed. Add .25c. for spot sales. 65-70% Mn, 17-20% Si, 1.5% max. C.

Carload, bulk	6.05c.
2000 lb. to carload	6.70c.
Under 2000 lb.	6.90c.
Briquets, contract, basis carlots, bulk freight allowed, per lb.	5.80c.
2000 lb. to carload	6.30c.
Less ton lots	6.55c.

Ferrochrome

(65-72% Cr, 2% max. Si)

OPA maximum base contract prices per lb. of contained Cr, lump size in carload lots, f.o.b. shipping point, freight allowed to destination. Add .25c. per lb. contained Cr for spot sales.

	Eastern Zone	Central Zone	Western Zone
0.06% C	23.00c.	23.40c.	24.00c.
0.10% C	22.50c.	22.90c.	23.50c.
0.15% C	22.00c.	22.40c.	23.00c.
0.20% C	21.50c.	21.90c.	22.50c.
0.50% C	21.00c.	21.40c.	22.00c.
1.00% C	20.50c.	20.90c.	21.50c.
2.00% C	19.50c.	19.90c.	21.00c.
66-71% Cr, 4-10% C	13.00c.	13.40c.	14.00c.

PRICES

Other Ferroalloys

Ferrotungsten, Standard grade, lump or ¼X down, packed, f.o.b. plant at Niagara Falls, New York, Washington, Pa., York, Pa., per lb. contained tungsten, 10,000 lb. or more... $1.90

Ferrovanadium, 35-55%, contract basis, f.o.b. producer's plant, usual freight allowances, per usual freight allowances, per lb. contained Va.

Open Hearth	$2.70
Crucible	$2.80
Primos	$2.90

Cobalt, 97% min., keg packed, contract basis, f.o.b. producer's plant, usual freight allowances, per lb. of cobalt metal $1.50

Vanadium pentoxide, 88%-92% V_2O_5 technical grade, contract basis, any quantity, per lb. contained V_2O_5. Spot sales add 5c. per lb. contained V_2O_5 ..... $1.10

Ferroboron, contract basis, 17.50% min. Bo, f.o.b. producer's plant with usual freight allowances, per lb. of alloy.

2000 lb. to carload	$1.20
Under 2000 lb.	1.30

Silcaz No. 3, contract basis, f.o.b. producer's plant with usual freight allowances, per lb. of alloy. (Pending OPA approval)

Carload lots	25c.
2000 lb. to carload	26c.

Silvaz No. 3, contract basis, f.o.b. producer's plant with freight allowances, per lb. of alloy (Pending OPA approval)

Carload lots	58c.
2000 lb. to carload	59c.

Grainal, f.o.b. Bridgeville, Pa., freight allowed 50 lb. and over, max. based on rate to St. Louis

No. 1	87.5c.
No. 6	60c.
No. 79	45c.

Bortram, f.o.b. Niagara Falls

Ton lots, per lb.	45c.
Less ton lots, per lb.	50c.

Ferrocolumbium, 50-60%, contract basis, f.o.b. plant with freight allowances, per lb. contained Cb.

2000 lb. lots	$2.25
Under 2000 lb. lots	$2.30

Ferrotitanium, 40%-45%, f.o.b. 0.10c. max. Niagara Falls, N. Y., ton lots, per lb. contained Ti.. $1.23

Less ton lots $1.25

Ferrotitanium, 20%-25%, 0.10 C max., ton lots, per lb. contained titanium $1.35

Less ton lots $1.40

High-carbon ferrotitanium, 15%-20%, 6%-8% carbon, contract basis, f.o.b. Niagara Falls, N. Y., freight allowed East of Mississippi River, North of Baltimore and St. Louis, per carload $142.50

Ferrophosphorus, 18% electric or blast furnaces, f.o.b. Anniston, Ala., carlots, with $3 unitage freight equaled with Rockdale, Tenn., per gross ton $58.50

Ferrophosphorus, electrolytic 23-26%, carlots, f.o.b. Monsanto (Siglo), Tenn., $3 unitage freight equalized with Nashville, per gross ton $75.00

Ferromolybdenum, 55-75%, f.o.b. Langeloth, Washington, Pa., any quantity, per lb. contained Mo. 95c.

Calcium molybdate, 40%-45%, f.o.b. Langeloth and Washington, Pa., any quantity, per lb. contained Mo ..... 80c.

Molybdenum oxide briquetes, 48%-52% Mo, f.o.b. Yangeloth, Pa., per lb. contained Mo ..... 80c.

Molybdenum oxide, in cans, f.o.b. Langeloth and Washington, Pa., per lb. contained Mo ..... 80c.

Zirconium, 35-40%, contract basis, f.o.b. producer's plant with freight allowances, per lb. of alloy. Add ½c. for spot sales

Carload lots	14c.

Zirconium, 12-15%, contract basis, lump, f.o.b. plant usual freight allowances, per lb. of alloy

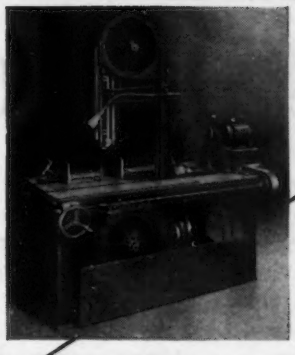
Carload, bulk	4.6c.

Alsifer (approx. 20% Al, 40% Si and 40% Fe), contract basis, f.o.b. Niagara Falls, carload, bulk ..... 5.75c.

Ton lots ..... 7.25c.

Simanal (approx. 20% Si, 20% Mn, 20% Al), contract basis, f.o.b. Philo, Ohio, with freight not to exceed St. Louis rate allowed, per lb.

Car lots	8.75c.
Ton lots	9.25c.



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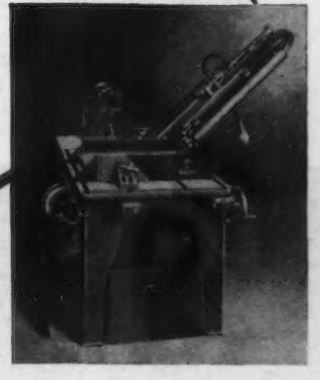

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